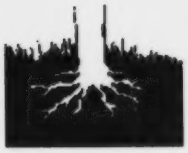

Root Disease Management Course

Instructor's Guide

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Overview

The Root Disease Management Training Course has been developed to provide training in root disease management to forestry management personnel working in the various regions of the province. The course has been structured to follow the *Root Disease Management Guidebook (RDM Guide)*. In fact, one of the main reasons for the development of the course is the need to introduce this guide to forestry professionals and technicians; the *RDM Guidebook* supports the associated sections of the Forestry Practices Code and regulations and standards and provides a methodology for the management of root disease.

In addition, and no less importantly, the course is intended to give you practical, hands-on experience in root disease identification and management through various exercises, discussions and field sessions.

If you have any questions or comments about these course materials, please contact Silviculture Practices Branch, Forest Health.

Target Audience

Participants will be forestry technicians and professionals who are responsible for evaluating root disease and prescribing treatment - as well as those silviculture personnel who want to achieve a better understanding of root disease. These persons have received post-secondary education in forestry and are generally familiar with forest health issues. Participants are likely not as familiar with the practicalities of treating root disease in the field nor are they familiar with the Forestry Practices Code as it relates to root disease management.

Organization

The Root Disease Management Training Course is delivered in five sections: three classroom sessions and two field sessions. The length of these sessions, their emphases, and order of their presentation (to a certain extent) may be adjusted by the instructor according to the general knowledge of your participant group and the logistical requirements of the field sessions.

Training Prerequisites

Participants are not required to complete any pre-study material, although as mentioned, they should be forestry technicians or professional who are responsible for evaluating root disease and prescribing treatment (see target audience above). You may, however wish to assign additional reading between days one and two. In addition, you will need to provide participants with a list, before the course begins, of the equipment they must bring to the field sessions.

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Getting Ready

This section of the *Instructor's Guide* will help you prepare for delivering the course. It will give you details about:

- Teaching Tips
- Delivery Tips
- What you'll need to prepare
- An overview of Lesson Plans
- How the order of information delivery may be altered to accommodate any logistical requirements (sessions will switch between classroom setting and field setting, and so will require that you and your participants be transported between sites)

Teaching Tips

Adult Learners respond best to:

- *Participation* - Whenever possible, you should have the participant actively involved in the learning experience; for example, ask questions and have participants practice demonstrated techniques.
- *Feedback* - The participant wants to know how he/she is progressing, so you should give specific and constructive feedback.
- *Practicality* - You are administering job training, and the participant will need to understand the reasons underlying certain procedures.
- *Application* - The participant will learn best from experience, and so exercises have been incorporated into the course material so that hands-on experience can be gained. Exercises are conducted both during the classroom sessions and the field sessions.
- *Examples* - Real on-the-job experiences can help to enliven material and establish the relevancy of theoretical instruction to the practicalities of the everyday working world of the forestry professional.
- *Variety* - Use a variety of teaching techniques: lectures, discussions, exercises, demonstrations, use of visual aids - a variety will help maintain the interest and pace of the course.

Delivery Tips

- *Keep the information as simple as you can.* Don't clutter your point with confusing and unnecessary material. Root disease management is a complex subject and this two day course could easily be longer. You'll want to focus on the highlights and equip your participants with high-level skills that can be developed over the long term. Reference material has been included in the Participants' Guide and you can provide them with a list of resources (one of your prepatory tasks) which can help them further

develop their skills. Beyond resource material, practice-makes-perfect in root disease management.

- *Approach delivery as a series of small steps.* Always let your participants know what you are doing and where you are going so that they can absorb the knowledge in small, manageable pieces that are connected in a meaningful way.
- *Identify how each task fits into a larger process.* Much of this course is built around the Five-Phase Root Disease Management Process. Each step in this process consists of a number of smaller steps and/or sometimes-complex management decision-making. If you continually remind participants of the place of a certain piece of information within the Five-Phase Management Process, they will be better able to absorb the information.
- *Stress and reinforce important information.* This course builds on the growth of participants' knowledge as the course progresses, and some portions of the course are briefly introduced and then revisited in greater detail later on.
- *The most effective way to transfer information is to take a four-part approach:*
  - Introduce the information
  - Present the information
  - Summarize the information
  - Evaluate how much information has been absorbed.

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Preparation

- **Preparation: Reading**

In addition to the subject matter expertise which you already possess on root disease identification and management, you'll need to be very familiar with at least three documents:

- The *Instructor's Guide*, which you are now reading, and all the overheads which have been prepared to help you in your presentation.
- The points to be made with each overhead are self-evident, but you'll also want to be sure that you understand their relevance *before* you enter the classroom. Note also that overheads have also been made of many of the tables in the *RDM Guidebook*. These overheads haven't been specifically referenced in the *Instructor's Guide*, so you may want to look them over and decide if and when to use them.
- The *Participants' Guide*. This guide contains additional reference material which you should be familiar with and which you may want to incorporate into your lectures and discussions as time allows. The *Root Disease Management in British Columbia Guidebook*. This Guidebook, as mentioned earlier, is one of the primary reasons for developing this course. Under the new Forestry Practices Code, the guide supports the standards and regulations which pertain to root disease management in the province. It is imperative that forestry professionals throughout the province become familiar with its mandate and contents.

- **Preparation: Resource List**

The Ministry of Forests possesses a well-stocked library of video tapes, publications, and other material which can aid you and your participants in further developing your knowledge of root disease management. Some of these publications are available in reprinted form for general distribution, while other materials are available for loan to individuals for specified periods of time.

A list of suggested resource material appears at the end of this preface. It's up to you to research the available material and decide what you want to introduce to your class as reference. Note, however, that additional materials, aside from occasionally providing relevant support material, should be considered only as references to be accessed outside of the course; over the length of the two-day course, you likely won't have a lot of extra time to introduce additional material within the class.

- **Preparation: Your Method of Delivery**

  This *Instructor's Guide* provides you with *key points* to guide your delivery of material. The guide does *not* micro-manage your speech. this is intentional, as there is nothing more dry than listening to an instructor "read" course material out loud.

  Therefore, you have a responsibility to become familiar with the key points so that you can refer to them as prompters, and leave the rest to your sparkling personality. The guide, however has been specifically organized so that you won't lose your way as you go through the material.

- **Preparation: Root Disease Classroom Identification (Classroom Session 1)**

  The *Instructor's Guide* provides you with a number of key lecture points on root disease identification, such as the difference between signs and symptoms, and the general signs and symptoms to look for when searching for root disease. Beyond these key points, this section of the course must rely heavily on visual material which illustrates the "Real McCoy" and supporting lecture/discussion points. This material has not been prepared for the course and it's your responsibility to do so.

  You'll have about an hour to deliver the entire section, some of which will be taken up with aforementioned key points and associated overheads as well as discussion and exercises. Be sure to leave enough room to spend sufficient time on the most vital part - the visual support material; the ability to recognize root disease is one of the critical skills to impart to participants.

  Prepare sufficient slides, videos, and/or real-life forest samples which can be brought into the class, plus supporting lecture notes. Read through the section on class-based root disease identification and get an idea for the kinds of exercises that you can present at the end; some will require additional slides/samples which haven't yet been seen by the participants.

  Be prepared to discuss the following points in the context of your visual support material:
  - Discuss symptoms and signs of various root diseases and clearly distinguish between each.
  - View root disease examples under varying conditions including, host, zone and with other pathogens.
  - Examine difficulty of pathogen recognition in a given range where the existence of several root diseases is common.
  - Emphasize the similarities between symptoms of Laminated Root Rot and Armillaria, and between Laminated Root Rot and Tomentosus Root Rot.

- **Preparation: Classroom Equipment**

  The classroom sessions require certain basic equipment. In addition to a suitable location within which to accommodate your participants you will need:
  - an overhead projector and extension cord
  - a slide projector and extension cord
  - overhead marker pens
  - at least one and preferably two projection screens (during the root disease identification classroom session you may want to show slides and overheads at the same time)
  - a flip chart and felt pens
  - any additional resources that you want to show the class such as books or brochures.

- **Preparation: Field Sessions 1 and 2**

  You will be escorting the participants on two field sessions. The first will focus on root disease identification, and the second will focus on surveying for and evaluating root disease. You will be *completely responsible* for arranging *every aspect* of these field sessions. Carefully read through the sections on the two field sessions;

then:

- select a number of sites which will best demonstrate the tasks at hand and plan how you will visit them. Try to select sites which contain examples of more than one disease and under varying conditions, especially for the first exercise on identification.
- Make yourself completely familiar with the diseases present on the sites. this will mean visiting and walking through the sites before the course begins. Allow yourself several days for this task.
- Make up handouts for all the practice areas.
- Make up handouts of the exercises which participants will perform while on-site.
- Bring along the following equipment to the field sessions
  - flagging tape
  - extra pulaskis
  - a felt pen
  - a knife
  - a small hand trowel
- Ask your students to bring along the following equipment(this list is also covered in the key points):
  - a knife
  - a pulaski, or similar tool
  - rain gear, other suitable shoes and clothing
  - hip chain
  - field notebook

- **VERY IMPORTANT NOTE:** *Since, in most cases, participants will be partaking in Field Session 1 on Day 1 of the course, you'll need to provide them with a list of these requirements BEFORE the course begins. You may need to phone them, write them, and/or be sure to include these requirements in any pre-course material that the participant sees.*

- The second field session requires that you conduct and leave in place - before the course begins - an appropriate root disease survey which can be viewed by the participants; there won' t be enough time to conduct a survey during the field session itself, so this is the next best thing. Be prepared to justify the type of survey you've chosen and to initiate discussion on its pros and cons in the context of the Five-Phase Management Process.
- Collect data from this survey to be used in Classroom Session 3 as participants decide for themselves how best to treat the root disease they have observed. That is, participants will conduct a Future Stand Risk Assessment and an Evaluation/Final Prescription based on their observations and the data you provide to them.
- Arrange for transportation to, from, and between the sites at the appropriate times.
- Both field sessions are combined with lunch; if weather is inclement, you may want to eat on the bus so a bag lunch is preferable to a catered affair. If your participants are from out of town and don't have access to kitchen facilities, you'll need to provide lunches for all participants and yourself.

- **Preparation: Exercises**

Some of the exercises require that you develop appropriate root disease problem scenarios so that participants can decide in a hypothetical manner how best to handle the problems. Again, read through the Instructor's Guide to understand how the exercises may fit with the course material; then go ahead and develop the scenarios based on your own subject-matter expertise.

You will probably have some specific instructions for both exercises which are site and exercise specific. You'll want to prepare handouts of these for distribution on site.

- **Preparation: Flexible Order of Presentation**

Some flexibility is afforded to you in the order in which you present the first three sections of the course.

- That is, you can present Classroom Session 1 and Field Session 1, followed by Classroom Session 2 (this is the "default " order in which the materials have been prepared). In this case you can further choose to present Classroom Session 2 on either Day 1 or Day 2.
- Or you can present Classroom Session 1 and 2, then follow with Field Session 1. In this case all three sessions must be presented on Day 1 (there won't be enough time for two field sessions).

Your decision in this area will largely depend on how your logistics for the field sessions are organized. Think about the sites you've chosen and the transportation arrangements that will be necessary. Think about the weather and if your participants would like to end the first day in a pleasant forest setting. Think about how much time it will take to get to and from sites. Think about how much time you want to spend on the final classroom session of the course. Then make your decisions accordingly.

You'll find more information on this in Lessons Plans, below.

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Lesson Plans

As mentioned earlier, the Root Disease Management Training Course consists of five sections; there is some flexibility in the order in which you can present this material. You may want to take advantage of this flexibility and make a few changes because of logistical needs of the Field sessions or because of time constraints and other factors. Below you'll find illustrations of the ways in which the sections can be moved around.

- **"Default" Order of Presentation**

The table below reflects the way in which the *Instructor's Guide* is organized when you first receive it. The "flex" section on "Step 1 of the Five-Phase Management Process" appears in Classroom Session 1 because this is an office exercise which should be performed before actually heading out to the field in the normal course of root disease management. Even though Field Session 1 should be focused on root disease identification, you may want to familiarize your participants with the concept of inherent risk in the context of the Five-Phase Management Process before they actually begin looking for root disease.

VERY IMPORTANT NOTE: The *Participant's Guide* has been organized to the "default" order; if you do make changes, don't forget to tell participants that you'll be presenting information in a different order.

Root Disease Management Course Overview "Default"

Day 1, Classroom Session 1 - about 3 hours	Day 1, Field Session 1 - about 4 hours	Day 1 or 2, Classroom Session 2 - about 1.5 hours	Day 2, Field Session 2 - about 4 hours	Day 2, Classroom Session 3 - about 3 hours
Course Introduction and Overview The Forest Practices Code Disease Management	Root Disease Identification in the Field	The Five-Phase Root Disease Management Process 1. Landscape Level Hazard	Perform/Observe Steps 2 and 3 of the Five-Phase Management Process: - Perform a	Perform Steps 4 and 5 of the Five-Phase Management Process:

Guidebook -Its Role -Its Contents The Role and Impact of Root Disease (Optional) Step 1 of the Five-Phase Management Process Root Disease Identification (in the Classroom)		and Risk Assessment 2. Silviculture Prescription Walk-through Reconnaissance 3. Disease Assessment and Stratification Survey 4. Future Stand Assessment 5. Evaluation and Final Prescription	Silviculture Prescription Walk-through Reconnaissance and determine the level of disease - Recommend for or against a survey and recommend a survey method - Observe a root disease survey - Observe the forest site and disease conditions where data were collected for use in Classroom Session 3	- Based on participant's observation from Field Session 2 and data provided by the instructor (data gained from the survey prepared by the instructor), perform a Future Stand Risk Assessment - Develop a Root Disease Treatment Evaluation - Develop a Final Prescription using strategies and tactics from the RDM Guide.

- **"Alternative" Order of Presentation**

If you find that it works better to present Field Session 1 at the end of the first day rather than in the middle, you'll want to present Classroom Session 2 directly after Classroom session 1. In this case the complete section on Step 1 (Landscape Level Hazard and Risk Assessment) is presented in Classroom Session 2 along with the rest of the steps. If you choose this option, simply take the freestanding pages on "Landscape Level Hazard and Risk Assessment" (which are included in the section Classroom Session 1 when you first receive this manual), and move them to the beginning of the Classroom Session 2 section.

Root Disease Management Course Overview "Alternate"

Day 1, Classroom Session 1 - about 2.5 hours	**Day 1, Classroom Session 2 - about 2 hours**	**Day 1, Field Session 1 - about 4 hours**	**Day 2, Field Session 2 - about 4 hours**	**Day 2, Classroom Session 3 - about 3 hours**

Course Introduction and Overview The Forest Practices Code Disease Management Guidebook -Its Role -Its Contents The Role and Impact of Root Disease Root Disease Identification (in the Classroom)	The Five-Phase Root Disease Management Process 1. Landscape Level Hazard and Risk Assessment 2. Silviculture Prescription Walk-through Reconnaissance 3. Disease Assessment and Stratification Survey 4. Future Stand Assessment 5. Evaluation and Final Prescription	Root Disease Identification in the Field	Perform/Observe Steps 2 and 3 of the Five-Phase Management Process: - Perform a Silviculture Prescription Walk-through Reconnaissance and determine the level of disease - Recommend for or against a survey and recommend a survey method - Observe a root disease survey - Observe the forest site and disease conditions where data were collected for use in Classroom Session 3	Perform Steps 4 and 5 of the Five-Phase Management Process: - Based on participant's observation from Field Session 2 and data provided by the instructor (data gained from the survey prepared by the instructor), perform a Future Stand Risk Assessment - Develop a Root Disease Treatment Evaluation - Develop a Final Prescription using strategies and tactics from the RDM Guide.

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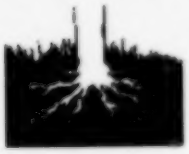

Root Disease Management Course - Introduction and Overview

DAY 1 - Classroom Session 1	Participant Objectives:
Introduction, Overview, Expectations, Preparation - About 10 minutes	Understand the skills which should be obtained through this course
COURSE INTRODUCTION AND OVERVIEW	LECTURE, ABOUT 10 MINUTES

Instructions	Key Points	Visual Aid
You and your participants should perform a few brief introductions to "break the ice". You should take this opportunity to assess the general skill level of your participants; this may impact the emphasis which you place on various sections of the course.	**INTRODUCTION** Introduce yourself, and talk about your experience/credentials in root disease management. Have your participants introduce themselves and briefly explain why they are attending and what they expect to gain from the course.	
The intent of this section is to briefly explain the main points which will be covered in the course and the order in which they will be presented . The key points here refer to the default presentation. If you deviate from this, make sure you choose the right overhead, revise these key points, and make your plans clear to your participants.	**OVERVIEW OF COURSE** **Classroom Session One** (lecture, discussion, exercise), about 3 hrs. Familiarization with the *Forest Practices Code Root Disease Management Guidebook*, the new "bible" of root disease management in British Columbia The role and impact of root disease Step 1 of the Five-Phase Management Process (Landscape Level Hazard and Risk Assessment)	OH 1 (a or b)

Root disease identification in class

Field Session One (hands-on experience), 4 hrs.

Root Disease identification in the field

Optional: In Field Session 1, you may also want to introduce participants to the Silviculture Prescription Walkthrough Reconnaissance (Step 2 of the Five-Phase Management Process) and Disease Assessment and Stratification Survey (Step 3); participants will actually be practicing these skills in Field Session 2.

Classroom Session Two (lecture, discussion, exercise), about 1.5 hrs

The Five-Phase Root Disease Management Process:

- Step 1. Landscape Level Hazard and Risk Assessment (review)
- Step 2. Silviculture Prescription Walkthrough Reconnaissance
- Step 3. Disease Assessment and Stratification Survey
- Step 4. Future Stand Risk Assessment
- Step 5. Evaluation and Final Prescription

Field Session Two (hands-on experience), about 4 hrs.

	The Five-Phase Root Disease Management Process with emphasis on Steps 2 and 3a/b: Step 2. Silviculture Prescription Walkthrough Reconnaissance Step 3a and 3b. Disease Assessment Survey and Stratification	
	Classroom Session Three (lecture, discussion, exercise), about 3 hrs. The Five-Phase Root Disease Management Process with emphasis on Steps 4 and 5: Step 4. Future Stand Risk Assessment Step 5. Evaluation and Final Prescription Participants will work with the observations and data obtained during Field Session Two to: Step 4. Perform a Future Stand Risk Assessment Step 5. Perform a disease evaluation and develop a final prescription.	

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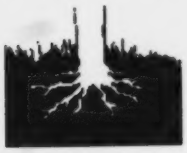

Root Disease Management Course - Introduction and Overview

DAY 1 - Classroom Session 1	Participant Objectives:
Introduction, Overview, Expectations, Preparation - About 10 minutes	Understand the skills which should be obtained through this course
COURSE INTRODUCTION AND OVERVIEW	LECTURE, ABOUT 10 MINUTES

Instructions	Key Points	Visual Aid
You and your participants should perform a few brief introductions to "break the ice". You should take this opportunity to assess the general skill level of your participants; this may impact the emphasis which you place on various sections of the course.	**INTRODUCTION** Introduce yourself, and talk about your experience/credentials in root disease management. Have your participants introduce themselves and briefly explain why they are attending and what they expect to gain from the course.	
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Root disease identification in class

Field Session One (hands-on experience), 4 hrs.

Root Disease identification in the field

Optional: In Field Session 1, you may also want to introduce participants to the Silviculture Prescription Walkthrough Reconnaissance (Step 2 of the Five-Phase Management Process) and Disease Assessment and Stratification Survey (Step 3); participants will actually be practicing these skills in Field Session 2.

Classroom Session Two (lecture, discussion, exercise), about 1.5 hrs

The Five-Phase Root Disease Management Process:

- Step 1. Landscape Level Hazard and Risk Assessment (review)
- Step 2. Silviculture Prescription Walkthrough Reconnaissance
- Step 3. Disease Assessment and Stratification Survey
- Step 4. Future Stand Risk Assessment
- Step 5. Evaluation and Final Prescription

Field Session Two (hands-on experience), about 4 hrs.

	The Five-Phase Root Disease Management Process with emphasis on Steps 2 and 3a/b: Step 2. Silviculture Prescription Walkthrough Reconnaissance Step 3a and 3b. Disease Assessment Survey and Stratification	
	Classroom Session Three (lecture, discussion, exercise), about 3 hrs. The Five-Phase Root Disease Management Process with emphasis on Steps 4 and 5: Step 4. Future Stand Risk Assessment Step 5. Evaluation and Final Prescription Participants will work with the observations and data obtained during Field Session Two to: Step 4. Perform a Future Stand Risk Assessment Step 5. Perform a disease evaluation and develop a final prescription.	

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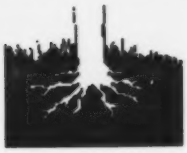

Root Disease Management Course - Expectations

DAY 1 - Classroom Session 1	Participant Objectives:
Introduction, Overview, Expectations, Preparation - About 10 minutes	Understand the skills which should be obtained through this course
COURSE EXPECTATIONS	

Instructions	Key Points	Visual Aid
	EXPECTATIONS	Start OH 2
The intent of this section is to emphasize that root disease management is a complex skill that must be practiced over the long term. In the long term, participants are expected to gain these skills and knowledge -	**Longterm** Root disease management is a complex process which requires a great deal of decisionmaking. Participants will take the knowledge they gain in this course and work with it regularly in the field so as to become adept at root disease management.	
In the short term, participants are expected to gain these skills and knowledge -	**Short Term** Become familiar with the Five-Phase Root Disease Management Process as outlined in the Root Disease Management Guidebook Become familiar with the role and contents of the Forest Practices Code Root Disease Management Guidebook Gain the habit of referring to the Forest Practices Code Root Disease Management Guidebook when dealing with root disease issues	

	Become familiar with the signs and symptoms of root disease; become reasonably proficient in identifying root disease in the field Learn how to apply the various steps in the Management Process to actual root disease management in the field Be able to develop an appropriate prescription for root disease observed in the field	

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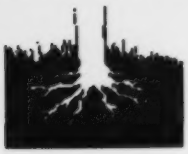

Root Disease Management Course - Preparation

DAY 1 - Classroom Session 1	Participant Objectives:
Introduction, Overview, Expectations, Preparation - About 10 minutes	Understand the skills which should be obtained through this course
COURSE PREPARATION	

Instructions	Key Points	Visual Aid
	PREPARATION	
You may want participants to complete **additional reading** which is important but which won't be covered during the course. Additional reading may include bulletins available from the Ministry of Forests, and other material you feel is appropriate.	**Additional Participant Reading (optional)** It is suggested/expected that participants will read the following: (instructor to make own notes here)	
Field sessions require special preparations. Brief participants on what they will need to bring to the field sessions. You may want to add more detail about the sites you'll be visiting in order generate enthusiasm for the trips.	**Field Session Preparation** • For *Field Session 1* During Field Session 1, you will be visiting sites to perform Root Disease Identification in the field. Other field work will include: _ You are to meet at__location at_o'clock Lunch will/will not be provided • For *Field Session 2* During Field Session 2, you	Start OH 2.5

	will be visiting sites to perform a Silviculture Walkthrough Assessment and observe a survey which will be prepared ahead of time (time does not allow us to conduct a survey during the class). Other field work will include:_	
Don't forget your own equipment needs; see the front of this guide for more complete instructions on field session preparations.	You are to meet at__ location at_ o'clock. Lunch will/will not be provided • Preparation for *Both Field Sessions*	
If your participants are from out of town and don't have access to kitchen facilities, you'll need to provide them with bag lunches.	You should be prepared for both field sessions by wearing/bringing the following: Suitable clothing and footwear (each field session will last about four hours); don't forget rain gear A knife A Pulaski or similar tool A hip chain	
You'll need to provide participants with these handouts.	Your *Participants' Guidebook* The *Field Guide to Pests of Managed Forests in British Columbia* The handouts given to you by the instructor of site maps and exercise instructions	

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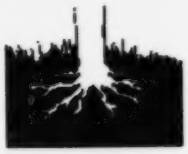

Root Disease Management Course - The Role of the Forest Practices Code Root Disease Management Guide Book

DAY 1 - Classroom Session 1	Participant Objectives:
The Forest Practices Code Root Disease Management Guide Book: **A. The Role of the RDM Guide Book - About 10 min.** B. What the RDM Guide Book Contains - About 20 min. The Role and Impact of Root Disease - About 30 min Step 1 of the 5-Phase Management Process (optional) - About 30 min. Root Disease Identification About 1 hr.	**- Understand and be able to explain the role of the RDM Guide.** - Learn how to consider root disease in silviculture and stand management prescriptions. - Be able to assess the inherent root disease risk in a particular zone. - Become familiar with the appearance of the three main root diseases in B. C. under various conditions and in various species.
THE FOREST PRACTICES CODE ROOT DISEASE MANAGEMENT GUIDEBOOK:	**LECTURE & DISCUSSION, ABOUT 30 MIN**

Instructions	Key Points	Visual Aid
Encourage discussion on improvements expected for root disease management in province due to the introduction of this new field guide. The intent of this section is to explain: - how regulations and standards support the Forest Practices Code - the differences	One of the key motivations for presenting the Root Disease Management Course is to introduce forest technicians and professionals to the field guide, *Root Disease Management in British Columbia*. Participant understanding of the role of the RDM Guidebook and its use as a tool in root disease management is one of the primary objectives of the course. **THE ROLE OF THE RDM GUIDEBOOK:** **ABOUT REGULATIONS,**	**Start OH 3**

between regulations and standards - how the RDM Guidebook provides the "howto" to fulfill the requirements You may want to discuss these regulations in greater detail.	**STANDARDS, AND FIELD GUIDES** **Regulations . . .** · Lay out universal and fundamental forest practices · Apply **province-wide** · Are mandatory under the code **Standards...** · Are either **provincial** or **regional** in scope · Add more detail to Regulations · Are mandatory under the Code **Guidebooks...** · Are How-to guides · **Support** the Regulations and Standards ***Specific regulations relating to the RDM Guidebook*** · Operational Planning Regulation · Silviculture Practices Regulation	

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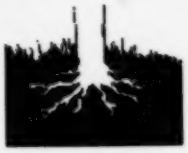

Root Disease Management Course - What The Forest Practices Code Root Disease Management Guide Book Contains

DAY 1 - Classroom Session 1	Participant Objectives:
The Forest Practices Code Root Disease Management Guide Book: A. The Role of the RDM Guide Book - About 10 min. **B. What the RDM Guide Book Contains - About 20 min.** The Role and Impact of Root Disease - About 30 min Step 1 of the 5-Phase Management Process (optional) - About 30 min. Root Disease Identification - About 1 hr.	**- Understand and be able to explain the role of the RDM Guide.** - Learn how to consider root disease in silviculture and stand management prescriptions. - Be able to assess the inherent root disease risk in a particular zone. - Become familiar with the appearance of the three main root diseases in B. C. under various conditions and in various species.
THE FOREST PRACTICES CODE ROOT DISEASE MANAGEMENT GUIDEBOOK:	**LECTURE & DISCUSSION, ABOUT 30 MIN**

Instructions	Key Points	Visual Aid
The intent of this section is to familiarize participants with the high- level contents of the RDM Guidebook.	**WHAT THE RDM GUIDEBOOK CONTAINS** · Recommended procedures, processes, andexpected results · Information to make site-specific interpretations and modifications within the restrictions and limits set by the Code · The best direction available when it was produced (but does not have to be rigidly adhered to) ***Types of diseases discussed in the guide***	**Start OH 4**

	Pathogen - - - - - - - - Code Laminated - - - - - - - - - DRL Tomentosus - - - - - - - -DRT Armillaria - - - - - - - - - DRA · Easy to remember which disease is referred to by a code's last letter. Other diseases included are Blackstain root disease and Annosus root disease but the three listed above are the main topics of discussion	**End OH 4** **Start OH 5**
Emphasize that one of the main reasons for developing this course is to introduce the Five-Phase Root Disease Management Process to forest professionals throughout the province.	**The RDM Guidebook and the Five-Phase Management Process** · The RDM Guidebook outlines the Five-Phase Management Process. The steps are: 1. Landscape Level Hazard and Risk Assessment 2. Silviculture Prescription Walkthrough Reconnaissance 3. a. Disease Assessment Survey b. Stratification 4. Future Stand Risk Assessment 5. Evaluation and Final Prescription	REMINDER: You will use OH 5 in other portions of the course so keep it handy.
If time allows, you may want to add a bit more detail about what the various steps entail. However, this	*A. The first three steps determine the level of the disease:* 1) Landscape level hazard and	

information will be covered in detail later in the course.	risk assessment - an office exercise to evaluate your biogeoclimatic unit 2) Silviculture prescription walkthrough reconnaissance - walk through the site and visually assess the level of disease - decide whether or not to survey, or go directly to Stratification and following steps 3) a. Disease assessment survey - if needed, accurately evaluate the level of disease with an appropriate survey method 3) b. Stratification (Stratification is always necessary, even if block is only one strata) *B. The last two steps help you decide how to treat the disease*	**End OH 5** **start OH 6**	
Ask your participants if they can name and describe steps 1, 2, and 3. Refer to RDM GuideBook pp 58-63	4) Future stand risk assessment - consider various factors such as disease type, host, environment, and management objectives 5) Evaluation and final prescription -consider various factors such as management objectives, site constraints, level and type of disease, and various strategies and tactics . **The RDM Guidebook provides tools and support for the Five-Phase Management Process**		
Refer to RDM Guidebook pp 27-35	*The RDM Guidebook's Disease Assessment Tools* - Are used in steps 1, 2 and 3		

	· Hazard and Risk Tables - to evaluate your biogeoclimatic zone · Survey methods - Different methods are used under different circumstances	Optional: RDM Overheads
Refer to RDM Guidebook pp 37-38 Discuss why these tools are used in steps 2 and 3. *REMINDER: Overheads of most tables and maps in the RDM Guidebook are provided in your Instructor's package. You can show some of them now if you want.*	- RDM Guidebook includes detailed instructions on how to conduct surveys - Formal surveys provide a more accurate estimate of the amount of disease present (degree of accuracy varies between surveys) · Threshold tables - Are used for both Steps 2 and 3 - Help you to determine need for survey using Reconnaissance survey threshold levels . - Are also used to determine minimal, alternate, or intensive disease treatment based on formal survey results	
Refer to RDM Guidebook pp 8-20 Discuss why these tools are used in steps 2 and 3.	*The RDM Guidebook's Disease Identification Tools* · Are used in steps 2 and 3 · Distribution maps · Table: Root Disease and Host Susceptibility · Table: Signs and Symptoms of Disease	
Refer to RDM Guidebook p 19 Refer to RDM Guidebook pp 39-53	*The RDM Guidebook's Disease Prescription Development Tools* · Are used in steps 4 and 5 · Table: Mode of Infection and Spread	

Refer to RDM Guidebook pp 54-55 If you have brought copies of these additional resources, you may want to show them now to your participants .	· Table: Host Susceptibility · Discussion of Disease dynamics · Detailed information on treatment levels, strategies, and tactics *The RDM Guidebook's Free Growing Guidelines* · Free Growing Guidelines will not be discussed in this course · Discuss other MOF identification tools such as *Field Guide to Pests...* which will be useful to participants as they are learning how to identify and manage root disease. · Tell participants about the resource centres provided by MOF where they can get more information about root disease.	

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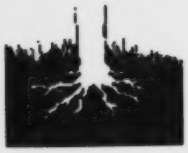

Root Disease Management Course - The Role and Impact of Root Diseases

DAY 1 - Classroom Session 1	Participant Objectives:
The Forest Practices Code Root Disease Management Guide Book: A. The Role of the RDM Guide Book - About 10 min. B. What the RDM Guide Book Contains - About 20 min. **The Role and Impact of Root Disease - About 30 min.** Step 1 of the 5-Phase Management Process (optional) - About 30 min. Root Disease Identification - About 1 hr.	- Understand and be able to explain the role of the RDM Guide. **- Learn how to consider root disease in silviculture and stand management prescriptions.** - Be able to assess the inherent root disease risk in a particular zone. - Become familiar with the appearance of the three main root diseases in B. C. under various conditions and in various species.
THE FOREST PRACTICES CODE ROOT DISEASE MANAGEMENT GUIDEBOOK:	**LECTURE & DISCUSSION, ABOUT 30 MIN**

Instructions	Key Points	Visual Aid
The intention of this section is to convey that: ·Root disease in unmanaged forests is usually in balance with the ecology and hosts, and has some good effects. · Root disease in managed forests can interfere with silviculture and stand objectives, but balance can be achieved with effective management.	**ROLE OF ROOT DISEASES IN ECOSYSTEMS** **In Unmanaged forests . . .** · are components of forests · cause endemic disease that is in balance overall with hosts · biological or environmental changes cause fluctuations in disease levels · dead trees provide habitat for animals · gaps sometimes allow for snow retention	**Start OH 7**

	·act as decomposers and contribute to processes of: ·nutrient cycling ·gap dynamics ·ecological succession ·biodiversity · But, Armillaria can adversely affect herbs and shrubs, thus also ungulates	**End OH 7** **start OH 8**
	In Managed Forests . . . · Important that a balance is achieved between the pathogen, site ecology, and other factors · Important that management objectives and prescriptions are developed in light of constraints of pathogen biology and site ecology · Important to recognize and understand pathogens in each ecosystem · Forestry activities can significantly alter disease expression by: - creating new food sources and thus triggering disease spread. - causing an alteration in species composition and stand structure, especially density - regeneration/understory release, especially hardwoods · Ecosystembased forestry management strives: - to maintain function of root pathogens - NOT to create	**End OH 8** **start** **OHs 9-11** **(Maps)** **End OHs 9-11**
Adjust the amount of information you provide on root disease impact depending on knowledge levels and time available.		

	conditions that favor pathogens over other ecological site factors	
	IMPACT OF ROOT DISEASES	
	· Root disease is very serious and must be considered at all levels of planning	**Start OH 12**
	General Impact	
	· Are widespread in all forested B.C. ecosystems	
	· Can reduce tree growth, lower wood quality, cause early mortality	**End OH 12**
	· Impacts wildlife, visual quality, water quality and production, and other resources	**Start OH 13**
	· Should be considered at all levels of planning even if not always treated	
	· Increases management complexity and risk	
	- limits species selection - intensive forestry carries high risk; may trigger disease silviculture investment may be wasted if root disease is not managed effectively, but cost of management may be quite high	**End OH 13** **Start OH 14**
To emphasize the impact of root disease, you may wish to use some of the timber impact figures contained in the reference material in the Participants' Guide.	· All species are susceptible to most types of root disease	
	- Trees of any age are susceptible - Likelihood of infection increases with age (because root contact increases)	**End OH 14** **Start OH15**

	- Impact decreases with age: with Armillaria, trees with large root collars take longer to be girdled and therefore the mortality rate partly depends on tree size and thus age; with Laminated, trees 80 to 100 years old may survive for 15 years; with Tomentosus, it takes longer to kill older trees.	**End OH 15**
	IMPACT OF SPECIFIC DISEASES *Impact of Armillaria* · Causes some plantations to become NSR (which were established without recognizing or treating root disease) · Disturbance increases disease · Is a relationship between vigour and susceptibility · In interior, has significant impact on species composition with decrease in Douglas-firs and replacement with other species · On coast, may result in conversion to more tolerant species such as cedar or hardwoods · Affects volume	
	Impact of Phellinus · Mortality greater in secondgrowth stands with increased losses projected for third growth stands	

	· Is a relationship between vigour and susceptibility · Affects volume · Reduction in growth and yield	
	Impact of Tomentosus · May affect species composition by reducing spruce component of stands but this is not proven · Decrease in growth and yield · Is a relationship between vigour and susceptibility · Likelihood of infection increases with age	

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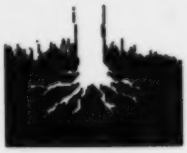

Root Disease Management Course - Step 1 of the Five-Phase Management Process (optional)

DAY 1 - Classroom Session 1	Participant Objectives:
The Forest Practices Code Root Disease Management Guide Book: A. The Role of the RDM Guide Book - About 10 min. B. What the RDM Guide Book Contains - About 20 min. The Role and Impact of Root Disease - About 30 min. **Step 1 of the 5-Phase Management Process (optional) - About 30 min.** Root Disease Identification - About 1 hr.	- Understand and be able to explain the role of the RDM Guide. - Learn how to consider root disease in silviculture and stand management prescriptions. **- Be able to assess the inherent root disease risk in a particular zone.** - Become familiar with the appearance of the three main root diseases in B. C. under various conditions and in various species.
LANDSCAPE LEVEL HAZARD AND RISK ASSESSMENT	**LECTURE & DISCUSSION and EXERCISE, ABOUT 30 MIN**
If you are presenting Field Session 1 before Classroom Session 2, you should present step 1 of the FivePhase Management Process in greater detail now. This section is followed by an exercise. *If, however, you are representing Field Session 1 AFTER Classroom Session 2, then present this section along with the other steps of the FivePhase Management Process, that is, at the beginning of Classroom Session 2.*	*Note that this section begins and ends on its own pages so you can move it to the appropriate point in the guide.* *You should keep the lecture portion of this section brief and spend most of your time on the exercise which appears at the end of this section.*

Instructions	Key Points	Visual Aid
Refer to RDM Guidebook p 23 The intent of this section is to familiarize the participants with an essential part of the Five-Phase	**STEP 1 of the Five-Phase Management Process: Landscape Level Hazard and Risk Assessment** · This assessment should also be included in Forest Development Plans or other higher level plans	**start OH 5.1**

Management Process before the first Field Session; note that this is an office-based procedure. Continue to encourage use of the RDM Guidebook when managing root disease *REMINDER: Overheads of most tables and maps in the RDM Guidebook are provided in your Instructor's package. You can show some of them now if you want.*	· Is a preliminary assessment conducted in the office, provides a reasonable level of guidance · Is **not** to be considered the sole evaluation · Consider two key factors: A. The hazard inherent in the ecosystem at the biogeoclimatic subzone level and the susceptibility of the indicated forest cover; and B. The risk (or probability of root disease and its expected damage impact) in a polygon or block · Forest pathologists have considered these factors in the RDM Guidebook's Hazard and Risk tables - Tables are in Section 9.0 of guide, beginning on page 58 - Each table identifies regional high hazard biogeoclimatic subzones that have a high probability of root disease occurrence and which will require evaluation as part of the prescription process **Exercise** 1. Conduct a Landscape Hazard Risk Assessment for your region using the tables in Section 9 of the RDM Guidebook. 2. Conduct an assessment for the particular site that you will be observing in Field Session 1. 3. If your participants come from various regions, assess the hazard in each region.	**Optional:** **RDM** **Overheads** **END OH5.1**

	4. Discuss other factors that may influence the inherent risk such as species type, age of trees, past forest practices, etc.	

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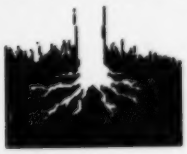

Root Disease Management Course - Root Disease Identification

DAY 1 - Classroom Session 1	Participant Objectives:
The Forest Practices Code Root Disease Management Guide Book: A. The Role of the RDM Guide Book - About 10 min. B. What the RDM Guide Book Contains - About 20 min. The Role and Impact of Root Disease - About 30 min. Step 1 of the 5-Phase Management Process (optional) - About 30 min. **Root Disease Identification - About 1 hr.**	- Understand and be able to explain the role of the RDM Guide. - Learn how to consider root disease in silviculture and stand management prescriptions. - Be able to assess the inherent root disease risk in a particular zone. **- Become familiar with the appearance of the three main root diseases in B. C. under various conditions and in various species.**
ROOT DISEASE IDENTIFICATION	**LECTURE & DISCUSSION and EXERCISE, ABOUT 1 HOUR**
The intent of this section is to introduce the participants to the visual qualities of root disease and prepare them for the field identification exercise which follows. You will spend the first portion of this section on the key points outlined in the following pages. Then, you will present the material you have prepared ahead of time: slides and other visual aids such as videos and actual root disease samples-along with supporting lecture and discussion points-so that participants hone their skills in visually identifying root disease. **PREPARATION:** The Root Disease Identification section requires that you prepare sufficient visual support material to demonstrate the visual differences between healthy and diseased trees and between various root diseases.	**Points to remember when showing visual support material for root disease identification:** - Discuss symptoms and signs of various root diseases and clearly distinguish between each - view root disease examples under varying conditions including host, zone, and with other pathogens - Examine difficulty of pathogen recognition in a given range where the existence of several root diseases is common. - Emphasize the similarities between symptoms of Laminated

Visual support material may include slides, videos, and actual samples brought in from the field to the classroom. You are also required to prepare your own lecture notes for much of this section. For more information, see the "Preparation" section in the beginning of this guide.	and Armillaria, and between Laminated and tomentosus.

Instructions	Key Points	Visual Aid
Review the RDM Guidebook's disease identification tools **REFERENCE MATERIAL:** The Participants' Guide contains additional information related to root disease identification. Be sure to refer participants to this information, and read it yourself before the course starts. A list appears at the end of this section. Ask participants to describe the difference between a sign and a symptom . Discuss the diseases which are common in participants' region(s) and their descriptions, and whether there is a predominance of a particular kind of disease in your region due to species susceptibility. Use OH 16 to direct a general discussion on the differences between signs and symptoms.	**DIFFERENCE BETWEEN SIGNS AND SYMPTOMS** · Symptom: An expression by the host that something is wrong · Sign: An actual indication of the causal agent of the dysfunction **Examples of Symptoms at Stand Level** · Mixture of species · Openings filled with dead/dying trees · Poor tree growth, lack of stand vigour · Insect attack	**Start OH 16**

	· Windthrow (with Laminated and Tomentosus)	
Some **symptoms** can be generally ascribed to all three diseases at the stand level.	**Examples of Symptoms at Tree Level** · Thinning foliage (all three) · Bent top (Armillaria)	
Some **symptoms** can be generally ascribed to all three diseases at the tree level.	· Basal resinosis(minor to copious resin flow at base of stem Armillaria) · Windthrown trees with few or no roots (Laminated) · Wind thrown spruce trees lacking fine root mass (Tomentosus)	
Some **signs** can be generally ascribed to all three diseases at the tree level.	**Examples of Signs at Tree Level** · Signs do NOT appear at Stand Level · Mycelial fan etchings on inner bark of dead trees (Armillaria) · Annual rings separate into sheets (Laminated) · Canoeshaped white pitting of the heartwood (Tomentosus)	**End OH 16** **start OHs 17,18, 19**
Use OHs 17 through 19 and the tables in the RDM Guidebook (pp 15-18) to drive your discussion of the specific differences	**Differences between signs and symptoms of the various diseases**	**End OHs 17,18, 19**

between signs and symptoms produced by each disease . * *PREPARATION: If you have two projection screens, you may want to show these overheads and begin your slide show at the same time.*		**Show your prepared visual support material for root disease identification including slides, samples, videos, etc.**
	· Discuss symptoms and signs of various root diseases and clearly distinguish between each · view root disease examples under varying conditions including host, zone, and with other pathogens · Examine difficulty of pathogen recognition in a given range where the existence of several root diseases is common. · Emphasize the similarities between symptoms of Laminated and Armillaria, and Laminated and Tomentosus.	
Now, begin your visual presentation and supporting lecture/discussion points which you have prepared ahead of time. * *PREPARATION: If you have two projection screens, you may want to show the previous overheads on signs and symptoms along with your slides.*	**Exercise** 1. Verbally describe some root disease signs and symptoms, and ask your participants to name the disease you are describing. Ask them to differentiate between signs and symptoms. 2. Display previously unseen slides and samples. Ask participants to name the root disease present and give supporting reasons.	
	REFERENCE MATERIAL: The Participants' Guide contains additional reference material on root disease identification to which you may want to draw participants' attention. Material includes:	

	· Table: Disease Cycle · The relationship of root disease to host, age, and vigour · Interactions of root diseases with other organisms	
	PARTICIPANT PREPARATION **FOR FIELD SESSION 1** If you are presenting Field Session 1 after this section, remind your participants of what they'll need for the field. Remember, you should give them this information BEFORE the course actually begins. Participants should bring: · Knife and pulaski or similar tool · Rain gear, other suitable clothing and footwear · Hip chain · Field notebook · *Participants' Guide* for this course · the handout material you will give them for the session including maps of the practice areas and exercise sheets	

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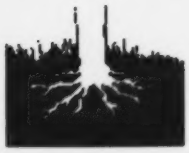

Root Disease Management Course - FIELD SESSION 1

DAY 1 - Field Session 1	Participant Objectives:
ROOT DISEASE IDENTIFICATION	FIELD SESSION, ABOUT 4 HOURS

Preparation and Instructions

You are responsible for making all arrangements for Field Session 1. The following is a "reminder" list; for complete instructions, see the section on Field Session Preparation at the beginning of this guide.

· Selecting the site (s)

· Preparing to lecture on the root diseases visible at the site

· Arranging transportation

· Preparing handout material including site maps and exercise instructions

· Providing lunches, if your participants are from out-of-town and don't have access to kitchen facilities

· reminding participants to bring/wear appropriate equipment

For a complete list of preparatory arrangements, see the section on "Preparation: Field Sessions" in the Introduction of this guide.

You should encourage the use of the identification tools in the RDM Guidebook during this field session. Review these tools with the participants:

· Distribution maps, RDM Guidebook pp 8-13

· Table: Root Disease and Host Susceptibility, RDM Guidebook p 14

· Table: Signs and Symptoms of Disease, RDM Guidebook p 15-18

Try to select a site (s) which contains examples of more than one disease and varying conditions (mature forests, regenerated forests, different

zones, species, in combination with other pathogens, variance in life cycle stage, etc.).

You may also want your participants to begin practicing Step 2 of the Five Phase Management Process -the Silviculture Walkthrough Reconnaissance-while they are gaining experience in identifying root disease. If so, you should review this process with them as well as the threshold tables (pp 3738 in the RDM Guidebook) before beginning the Identification session.

Finally, although you will cover the topic of survey types in detail during Field Session 2, you may want your participants to begin thinking about various alternatives during this field session as well. If so, you should lead a brief discussion at the end of the field session.

Exercise Ideas for Root Disease Identification in the Field

1. Begin an initial identification through lecture and demonstration.

2. Continue to work with the participants but ask them to actively engage in identification.

3. Divide students into small groups (2 or 3 people) and ask them to conduct identification In different parts of the site(s). Ask them to return in a set period of time with, if possible, samples, and be prepared to identify and discuss what they've found.

4. Discuss the level of disease observed in light of Step 2 in the Five-Phase Management Process.

5. Discuss forest practices which could help/hurt the root disease observed.

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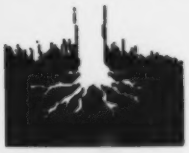

Root Disease Management Course - The Five-Phase Management Process

DAY 1 or 2 - Classroom Session 2	Participant Objectives:
The Five-Phase Management Process About 1.5 hrs. **1. Landscape Level Hazard and Risk Assessment** **2. Silviculture Prescription Walkthrough Reconnaissance** **3 Disease Assessment and Stratification Survey 4. Future RiskAssessment** **5. Evaluation and Final Prescription**	**Become familiar with the five steps which must be performed in the management of root disease.** **Be able to identify the contents of the RDM Guide which are used in conducting the five steps.**
THE FIVE-PHASE MANAGEMENT PROCESS	**LECTURE, DISCUSSION & EXERCISE, ABOUT 1.5 HRS.**
REMINDER: If you prefer, you may present Classroom Session BEFORE Field Session 1. If you do, remember to move the more complete section of Step 1 - Landscape Level Hazard and Risk Assessment to this section.	You 'll find the freestanding section on this step just before the section on the classroom session on Root Disease Identification. The information below represents only a review of Step 1.

Instructions	Key Points	Visual Aid
Review the RDM Guidebook's disease assessment tools. The intent of this section is to: - Increase the participants' knowledge of many of the details pertaining to the Five-Phase Management Process - Be prepared to actively apply the first three steps of the process during Field	**STEP 1. LANDSCAPE LEVEL HAZARD AND RISK ASSESSMENT** · Review this step in light of observations from Field Session 1 Was the level of root disease observed in the field "predicted" by the landscape level hazard and risk assessment exercise? If so/ why? If not, why not? What other factors (such as species, forestry activities, etc.) may	**Start OH 5-1** **End OH 5.1**

Session 2 - Continue to encourage use of the RDM Guidebook when managing root disease	have had an impact on the root disease observed in the field?	**Start OH 5.2**
Refer to RDM Guidebook p 23 and tables on pp 37-38 If you have already conducted Field Session 1, you may want to discuss Step 2 in light of your field observations. Discuss threshold levels specific to the region **REMINDER:** Overheads of most tables and maps in the RDM Guidebook are provided in your Instructor's package. You can show some of them now if you want.	**STEP 2. SILVICULTURE PRESCRIPTION WALKTHROUGH RECONNAISSANCE** - Is a forest exercise - Is an essential step, provides an early opportunity to evaluate stand hazard and risk, plus general incidence of disease - Objective is to provide a preliminary stratification of the site Inherent hazard and risk + Results of the walkthrough = Need for Survey Become familiar with information in threshold tables. Then, when conducting the walkthrough, look for threshold levels of the disease. - If the walkthrough reveals that disease is PRESENT BUT BELOW MINIMUM threshold level, EITHER proceed directly to Step 3B, stratification, OR proceed to a formal survey followed by stratification IF - the site is in a high hazard ecosystem AND/OR	Optional: RDM Overheads

	- the disease in question is Armillaria, which should be treated intensively wherever practicable given resource management objectives.	**End OH 5.2**
	- If disease is BETWEEN the minimum and maximum threshold levels, a more formal survey is needed; proceed to Step 3A of the Five- Phase Management Process. Follow with Step 3B, stratification.	**Start OH5.3**
	If disease is obviously ABOVE the maximum threshold level, then	
Refer to RDM Guidebook p 24 & pp 27-35)	- a formal survey is unnecessary	
If you are presenting this portion of the course after Field Session 1, you may want to discuss the survey methods which would be suitable for assessing the disease observed in the field.	- proceed directly to Steps 3B - stratification, 4 - future risk assessment, and 5 - evaluation and final prescription	
	STEP 3A. DISEASE ASSESSMENT SURVEY	
	· OBjective is TO proV ide an accurate estimate of the disease	
You may also want to ask the participants to review the survey methods you will be using during Field Session 2	· Several methods are available; each has strengths and weaknesses, and they differ in their ability to provide an accurate estimate of root disease.	
	· When developing survey objectives, one of the PRIMARY CONSIDERATIONS is the MANAGEMENT OBJECTIVES for the area.	

Discuss how management objectives might influence the survey you choose to conduct	· Other survey selection considerations include: - As level of precision increases, so does the cost/ha of the survey (potential cost is reason for importance of well-defined objectives - the questions that need to be answered, and the level of precision needed to answer them - Stand management objectives: For example, a survey designed for a 40 ha cutblock will be different from a survey designed to establish cutblock harvesting, patterns over the next rotation at a landscape level.	Start OH 20
REMINDER: Carefully read the section of survey methods to decide if you want to add more detail to the brief points included here. Give special attention to the survey type(s) you will be demonstrating in Field Session 2	· District Manager has final authority over any survey method used. - Final prescriptions are submitted to the District Manager and include details on the survey method used - If the District Manager disagrees with the survey method useds he/she can require that a new surey be conducted	
	Survey suitable for all diseases: **Transect**: A tree-based survey; functions as a simple method for observing and tallying disease incidence by pathogen and host. Depending on interval	

selected, this method also provides a fair estimate of disease location for stratification purposes

Laminated in Coastal Stands only:

Intersection Length: An area-based survey used for coastal Laminated because of disease's tendency to form discrete, well-defined infection centers

Can set up random or systematic survey transect grids and both can be run using a mapping option if desired

Sketch Mapping: Recommended for use only in coastal stands with Laminated.

Armillaria and Laminated in Interior Stands only:

Pixel: An area-based survey for interior stands where Armillaria and Laminated are expressed in centers, scattered patches, or as individual mortality

A pixel survey is essentially a transect survey divided into short plots

Pixel is 25 m long and 3 m wide, has one lengthwise edge along thecompass line.

Intensity Measuring Pixel Survey (IMPS): Used to detect, assess, stratify Armillaria and Laminated in the interior.

End OH 20

Start OH 5.3

Uses a variable-width pixel that samples about ten trees per pixel, grouping trees into 4

	diameter classes, and as either healthy or infected. Tree counts are weighted relative to tree diameter with each pixel (i e, small infected trees represent less inoculum than large infected trees). Thus, provides estimate of the area affected plus indication of intensity Its advantage is that it reflects the differing contribution to total on site inoculum load by varying size of infection source	**End OH 5.3** **Start OH 5.4**
Refer to RDM Guidebook p 25 Tell your participants that this section, and the following section, "Evaluation and Final Prescription", will be covered in more detail in Classroom Session 3, when participants are asked to develop a prescription based on observations made during Field Session 2. If you prefer, you can spend less time on these steps in this session and make these points instead in Classroom Session 3 Discuss the observations made during Field Session 1 in regard to Future	**Tomentosus:** **· S tump-To p (experimental):** Because of inconsistent expression of aboveground tree symptoms, surveying for root disease- particularly T'omentosus - in mature stands is difficult and costly. When no above-ground symptoms are evident, root assessment must be done by either drilling or chopping to thle core of roots. This is expensive and time consuming. An alternative to preharvest surveys is a postharvest stump top survey; many infected spruce trees have evidence of tomentosus infection at stump top. Is a strictly visual assessment; surveyors must be able to distinguish between the honeycomb pattern of heartwood decay caused by Tomentosus and other patterns of decay common in spruce.	**End OH 5.4** **Start OH 21** **End OH 21** **Start OH 5.5**

Stand Risk Assessment.	**STEP 3B. STRATIFICATION** Stratification is always necessary, whether or not a formal survey has been performed or disease is not present Objective is to look for sub-areas which may need different treatment.	
Review the RDM Guidebook's disease prescription development tools.	**STEP 4. FUTURE STAND RISK ASSESSMENT** Objective is to prevent the problems that call be created if only considering the short-term gain; must assess within the framework of a crop plan. Is highly integrated with step 5 "Evaluation and Final Prescriptions" · Is not a quantitative process but conceptual · Should be conducted on any site for which a prescription is being created · The Forest Health Management Triangle illustrates theconcept of Future StandRisk Assessment. Damaging Agent + Environment + Potential Host + Time = Probability of Damage (Future Stand Risk)	
Refer to RDM Guidebook, pp 37-43		

Refer to RDM Guidebook, pp 37-38

REMINDER: Overheads have been made of most of the tables ill the RDM Guidebook. You may use them here if you wish.

Refer to RDM Guidebook pp 39-43

Refer to RDM Guidebook pp 44-53

STEP 5. EVALUATION AND FINAL PRESCRIPTION

Objective of Step 5 is to produce an effective method of dealing with and controlling the disease within management objectives and site ecology; and to maintain or enhance identified resource values, to ensure long- term integrity, and productivity.

Paramount consideration should be given to site ecology when creating prescriptions

Stand management objectives should be adjusted where root disease incidence, site conditions, risks, or constraints dictate

This is preferable to prescribing an inappropriate root disease management treatment which places resource management objectives and future forest health at risk of failure.

Elements of developing a prescription

Future stand risk assessment +

'I'reatment Classes +

Treatment Methods: Strategies and tactics =

Prescription

Treatment Levels

· Selecting a treatlment level is an iterative process since for

	each disease incidence level there is a corresponding disease treatment level (minimal, alternate, and intensive) · Determine threshold levels by using survey results and RDM Guidebook		
REMINDER: You may want your participants to do some reading before Field Session 2 In preparation, they should be comfortable with Steps 2 and 3 of the Five-Phase Management Process.	The RDM Guidebook provides instructions for minimal, alternate, and intensive disease treatment levels for both silviculture prescriptions and stand management prescriptions. **Treatment Methods: Strategies and Tactics** · Once a treatment level has been determined, a treatment strategy(ies) can be chosen · Different strategies are suitable for use under different circumstances · Are four major treatment strategies for both silviculture and stand management prescriptions: Inoculum removal Alternate species selection Inoculum avoidance biological /chemical agents · Each strategy is associated with one or more tactics		

	· Not all strategies/tactics are suitable for all diseases · In addition, some are experimental. Contact Regional Pathologist for directions. · Preferred tactics are not always practical because of other constraining factors including: site constraints personnel constraints ecological constraints stand management considerations	
	EXERCISE 1. Develop several scenarios and ask participants to BRIEFLY: Suggest survey types which could be used to assess disease levels more accurately. Conduct a future stand risk assessment 2. Describe the site and survey methods which you will be observing in Field Session 2, and discuss the reasons for the choice of survey.	

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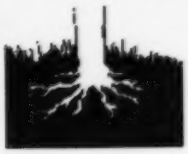
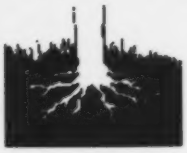


Root Disease Management Course - FIELD SESSION 2

DAY 2 - Field Session 2	Participant Objectives:
Performance/Observance of Steps 2 & 3 of the Five-Phase Management Process - About 4 hrs. A. Perform a Silviculture Prescription Walkthrough Reconnaissance B Determine the level of disease C. Recommend for or against a survey, and a survey method D. Observe a survey which has been prearranged E. Observe the forest site and disease conditions where data were collected for use In Classroom Session 3	-Learn how to conduct a field reconnaissance (walkthrough) and record requisite information. -Learn how to determine threshold levels of a root disease infestation under field conditions and when to conduct a survey. -Become familiar with the types of survey methods which can be used under regional and site circumstances and their strengths and weaknesses.
STEPS 2 AND 3 OF THE FIVE-PHASE MANAGEMENT PROCESS	**FIELD SESSION, ABOUT 4 HRS.**

Preparation and Instructions	Exercise/Discussion
You are responsible for making all arrangements for Field Session 2 including (for a complete list, see the Preface): · selecting the site (s) · conducting an appropriate survey beforehand for participant observation (participants will not be conducting an actual survey) · collecting data from your survey for use in Classroom Session 3, steps 4 and 5. · preparing to lecture on Steps 2 and 3 of the Five-Phase Management Process · arranging transportation	· Perform a silviculture walkthrough assessment and discuss results in view of the threshold tables on pages 37 and 38 of the RDM Guidebook (step 2). If you have already discussed Steps 2 and 3 in some detail during Field Session 1, you may want to divide your participants into groups and have them conduct their own walkthroughs, reporting back to the group with their results. · Based on walkthrough observations, determine whether survey is necessary; if so, discuss the types of surveys which would be suitable and the reasons supporting this recommendation (preparing for step 3). · Examine the survey which you, the instructor, have conducted ahead of time. · Visually assess the results of the instructor's prepared survey.

· Providing lunches if participants are from out of town · reminding participants to bring/wear appropriate equipment as well as their *RDM Guidebooks* and the *Field Guide to Pests*. You should encourage the use of the disease assessment tools in the RDM Guidebook during this field session. Review these tools with the participants: · Hazard and Risk Tables pp 58-63 · Survey methods pp 27-3	· Discuss the reasons why this survey tvpe was chosen. · Observe forest site and disease conditions where data were collected which will be used in Classroom Session 4. **EVALUATION, FUTURE STAND RISK ASSESSMENT, AND FINAL PRESCRIPTION** **LECTURE, DISCUSSION & EXERCISE ABOUT 3 HRS.** In this section, participants will ACTIVELY APPLY Steps 4 and 5 of the Five-Phase Management Process to the observations and data collected from Field Session 2. After presenting lecture and discussion points, participants can be asked to work alone or in groups to develop a future stand risk assessment and a final prescription using the data from the field session and the RDM Guidebook. Participants should be very involved in developing the solutions for the disease observed in the field session. Key points and overheads have been prepared for this section in order to help you promote discussion. In addition, you may want to review the material presented earlier on steps 4 and 5 of the FivePhase Management Process; simply refer to the previous sections of this guide. You may also want to use the associated overheads again. As you are assisting participants to develop their prescriptions, emphasize again that the RDM Guidebook is a tool to be used as guide for the root disease management process.



Root Disease Management Course - The Five-Phase Management Process

DAY 2 - Classroom Session 3	Participant Objectives:
Evaluation, Future Stand Risk Assessment, and Final Prescription Total about 3 hrs. A. Future Stand Risk Assessment B. Root Disease Treatment Level Evaluation C. Treatment Methods: Strategies and Tactics	Demonstrate familiarity with the factors that influence future stand risk assessment, and how future stand risk assessment impacts prescription. Demonstrate efficacy in the process of evaluating a root disease infestation and prescribing appropriate treatment Recommend a disease treatment level, a treatment strategy and tactic based on survey results from Field Session 2.

Instructions	Key Points	Visual Aid
If desired, review material on Future Stand Risk Assessment covered earlier (Step 4).	**DEVELOPING A FUTURE STAND RISK ASSESSMENT** Refer to material presented earlier in this guide Supplement the review with the additional discussion points below on Future Stand Risk Assessment; do so in light of observations and data from Field Session 2.	Use overheads from earlier material including RDM overheads if needed
Ask the participants to develop a future stand risk assessment based on observations in Field Session 2. Use these points to promote discussion .	**When conducting a future risk assessment, consider these factors:** *Damaging Agent* · How much and what type of root disease is there? The incidence level of root disease, by strata Resident or transient	**Start OH 21**

	Population and proximity Potential How do we fix it? Recommended disease management strategies and tactics *Potential Host* What is on the site now, and what will be on site later? The existing and future host tree population (susceptibility/hazard, number and size, successional stage, desired future stand structure) Availability Stand structure and composition *Environment* Where is the site? The biogeoclimatic area: subzone, variant, site series Physical site character Past management *Time* · How has/will the stand be managed? How past, present, and future stand management practices affect root disease Incidence levels · Integration of process with Phase 5 (below)	**End OH 21** **Use Overheads from earlier material**
Discuss how and why Step 4 must be closely integrated with Step 5. If desired, review		

material on determining Treatment Levels (part of Step 5). Refer to RDM Guidebook pp 26-43. Supplement the review with the additional discussion points generated by OHs 21 and 22, and refer to the RDM Guidebook for more information on treatment levels; (do so **in light of observations and data from Field Session 2.**) Walk participants through the steps for determining a treatment level for the disease observed in Field Session 2.	**DETERMINING TREATMENT LEVELS** · Refer to material presented earlier in this guide Generallv review treatment levels for various diseases and levels · Determine an appropriate level of treatment for the disease observed in Field Session 2 by using the threshold tables Survey Method + Disease Type + Coast Or Interior + Disease Level = Treatment Level	**OHs 22, 23** **End OHs 22, 23** **RDM Overheads: Threshold** **Use overheads from earlier material**
If desired review material on determining Treatment Strategies and Tactics. Refer to RDM Guidebook pp 44-53 guide Supplement the review with the additional points below on Evaluation and Final Prescription: do so **in light of observations and data from Field Session 2.**	DEVELOPING STRATEGIES AND TACTICS · Refer to material presented earlier in this · Generally discuss various strategies, tactics, and constraining factors	**OHs 24, 25**
	FINAL EXERCISE Ask participants to prepare a final prescription andsupporting reasons based on: a. field observations from Field Session 2	

	b. hypothetical scenarios **Considerations.** Management objectives Treatment Strategies and tactics Impact of forestry practices Future Stand Risk Assessment Constraining factors Disease level Species type Other non-timber resource values **Ideas to keep in mind while answering questions** 1. How does the prescription fit in with stand objectives? 2. Why is this prescription the best? 3. What are the limitations of the prescription? 4. What are the expected consequences? 5. What additional information would yotl like to have to improve your prescription?	

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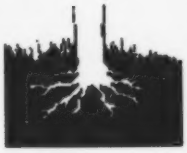

Root Disease Management Course

Overhead Images

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- OH.01 - Root Disease Management Course Overview "Default"
- OH.01 - Root Disease Management Course Overview "Alternative"
- OH.02 - Root Disease Management Course Expectations and Objectives
- OH.02.5 - Root Disease Management Course Field Session Preparation
- OH.03 - About Regulations, Standards and Guidebooks
- OH.04 - Disease Discussed in the RDM Guidebook
- OH.05 - Root Disease Five-Phase Management Course
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- OH.06 - The Tools in the RDM Field Guidebook
- OH.07 - The Role of Root Disease in Unmanaged Forests
- OH.08 - The Role of Root Disease in Managed Forests
- OH.09 - Distribution of Armillaria Root Disease
- OH.10 - Distribution of Tomentosus Root Rot
- OH.11 - Distribution of Laminated Root Rot
- OH.12 - Relationship Between Age of Tree and Root Disease
- OH.13 - Armillaria Root Disease
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- OH.16 - Disease Identification
- OH.17 - At the Stand Level, Look for these Symptoms
- OH.18 - At the Tree Level, Look for these Symptoms
- OH.19 - Signs Are Visible, Only at the Tree Level
- OH.21 - Future Stand Risk Assessment
- OH.22 - Silviculture Prescriptions by Disease Treatment Level
- OH.23 - Stand Managment Prescriptions by Disease Treatment Level
- OH.24 - Strategies and Tactics for Stand Managment Prescriptions
- OH.25 - Strategies and Tactics for Silviculture Prescriptions
- OH.05 - Root Disease Five-Phase Management Course

Day 1, Classroom Session 1 - about 3 hours	**Day 1, Field Session 1 - about 4 hours**	**Day 1 or 2, Classroom Session 2 - about 1.5 hours**	**Day 2, Field Session 2 - about 4 hours**	**Day 2, Classroom Session 3 - about 3 hours**
Course Introduction and Overview The Forest Practices Code Disease Management Guidebook -Its Role -Its Contents The Role and Impact of Root Disease (Optional) Step 1 of the Five-Phase Management Process Root Disease Identification (in the Classroom)	Root Disease Identification in the Field	The Five-Phase Root Disease Management Process 1. Landscape Level Hazard and Risk Assessment 2. Silviculture Prescription Walk-through Reconnaissance 3. Disease Assessment and Stratification Survey 4. Future Stand Assessment 5. Evaluation and Final Prescription	Perform/Observe Steps 2 and 3 of the Five-Phase Management Process: - Perform a Silviculture Prescription Walk-through Reconnaissance and determine the level of disease - Recommend for or against a survey and recommend a survey method - Observe a root disease survey - Observe the forest site and disease conditions where data were collected for use in Classroom Session 3	Perform Steps 4 and 5 of the Five-Phase Management Process: - Based on participant's observation from Field Session 2 and data provided by the instructor (data gained from the survey prepared by the instructor), perform a Future Stand Risk Assessment - Develop a Root Disease Treatment Evaluation - Develop a Final Prescription using strategies and tactics from the RDM Guide.

Day 1 Classroom Session 1

The Forest Practices Code Root Disease Management Guide Book:

A.The Role of the RDM Guide Book

B. What the RDM Guide Book Contains

The Role and Impact of Root Disease

Step 1 of the Five-Phase Management Process (Optional)

Root Disease Identification

Participant Objectives

- **Understand the skills which should be obtained through this course.**

Day 1, Classroom Session 1 - about 2.5 hours	Day 1, Classroom Session 2 - about 2 hours	Day 1, Field Session 1 - about 4 hours	Day 2, Field Session 2 - about 4 hours	Day 2, Classroom Session 3 - about 3 hours
Course Introduction and Overview The Forest Practices Code Disease Management Guidebook -Its Role -Its Contents The Role and Impact of Root Disease Root Disease Identification (in the Classroom)	The Five-Phase Root Disease Management Process 1. Landscape Level Hazard and Risk Assessment 2. Silviculture Prescription Walk-through Reconnaissance 3. Disease Assessment and Stratification Survey 4. Future Stand Assessment 5. Evaluation and Final Prescription	Root Disease Identification in the Field	Perform/Observe Steps 2 and 3 of the Five-Phase Management Process: - Perform a Silviculture Prescription Walk-through Reconnaissance and determine the level of disease - Recommend for or against a survey and recommend a survey method - Observe a root disease survey - Observe the forest site and disease conditions where data were collected for use in Classroom Session 3	Perform Steps 4 and 5 of the Five-Phase Management Process: - Based on participant's observation from Field Session 2 and data provided by the instructor (data gained from the survey prepared by the instructor), perform a Future Stand Risk Assessment - Develop a Root Disease Treatment Evaluation - Develop a Final Prescription using strategies and tactics from the RDM Guide.

Participant Objectives

- **Understand the skills which should be obtained through this course.**

Root Disease Management Training Course Expectations and Objectives

Long-Term Expectations	Short Term Expectations
• Root disease management is a complex process which requires a great deal of decision-making; participants will take the knowledge they gain in this course and work with it regularly in the filed so as to become adept at root disease management	• Become familiar with the Five-Phase Root Disease Management Process as outlined in the Root Disease Management Guidebook. • Become familiar with the role and contents of the Forest Practices Code Root Disease Management Guidebook • Gain the habit of referring to the Forest Practices Code Root Disease Management Guidebook when dealing with root disease issues • Become familiar with the signs and symptoms of root disease; become reasonably proficient in identifying root disease in the field • Learn how to apply the various steps in the Management Process to actual root disease in the field • Be able to develop an appropriate prescription for root disease observed in the field

Participant Objectives

- **Understand the skills which should be obtained through this course.**

Root Disease Management Training Course Field Session Preparation

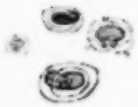
Field Session 1 **Root Disease Identification**	**Field Session 2** **Silviculture Prescription Walk-through, Reconnaissance & Disease Assessment and Stratification Survey**
During Field Session 1, you will be visiting __ site(s) to perform Root Disease Identification in the field. Other field work will include: _____ You are to meet at _____ location at _____time. Lunch will/will not be provided.	During Field Session 2, you will be visiting __ sites to perform a Silviculture Walk-through Assessment and observe a survey which will be prepared ahead of time (time does not allow us to conduct a survey during the class). Other field work will include:_____ You are to meet at _____ location at _____time. Lunch will/will not be provided.
Equipment to bring for both field sessions:	
- wear suitable clothing and footwear (each field session will last about four hours); don't forget rain gear. - A knife - A pulaski or similar tool	- A hip chain - Your Participant's Guidebook -The Field Guide to Pests - The handouts given to you by the instructor of site maps and exercise instructions.

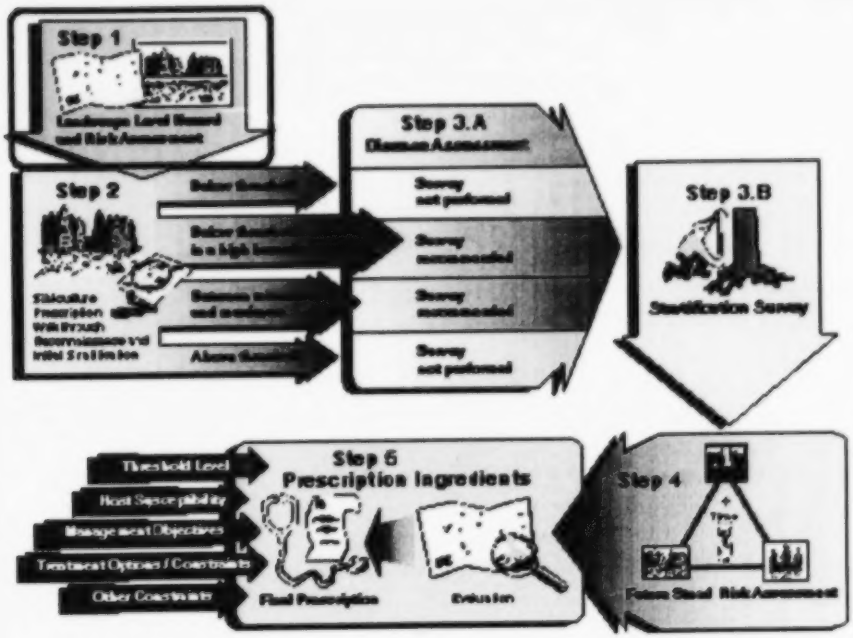
Participant Objectives

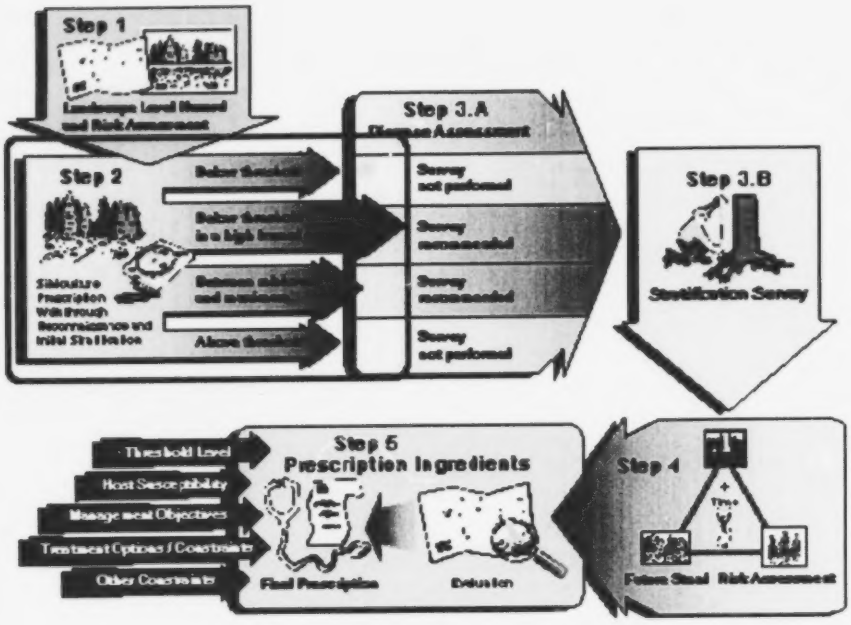
- **Understand and be able to explain the role of the RDM Guide.**
- Learn how to consider root disease in silviculture and stand management prescriptions.
- Be able to assess the inherent root disease risk in a particular zone.
- Become familiar with the appearance of the three main root diseases in B.C. under various conditions and in various species.

Forestry Practices Code
Regulations
Standards
Guide Books

Code	Common Name
DRL	Laminated Root Rot
DRT	Tomentosus Root Rot
DRA	Armillaria Root Disease
DRN	Annosus Root Disease
DRB	Blackstain Root Disease




Step 1
Step 2
Step 3.A
Step 3.B
Stratification Survey
Step 4
Step 5
Prescription Ingredients
Threshold Level
Final Prescription


Step 1
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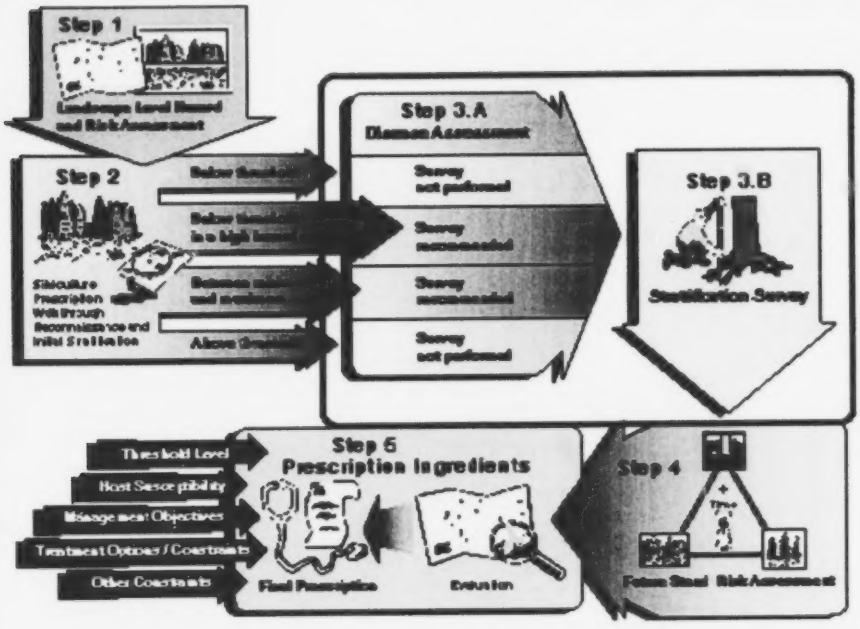
Step 3.A
Step 3.B
Stratification Survey
Step 4
Step 5
Prescription Ingredients
Threshold Level
Host Susceptibility
Management Objectives
Treatment Options / Constraints
Other Constraints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Sterilization Survey
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Step 5
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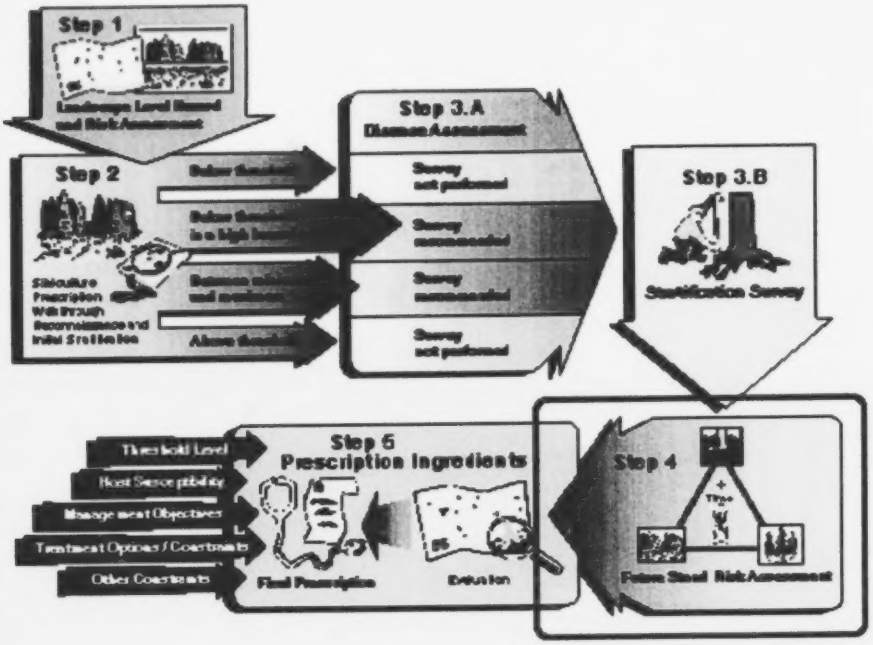
Treatment Options / Constraints
Other Constraints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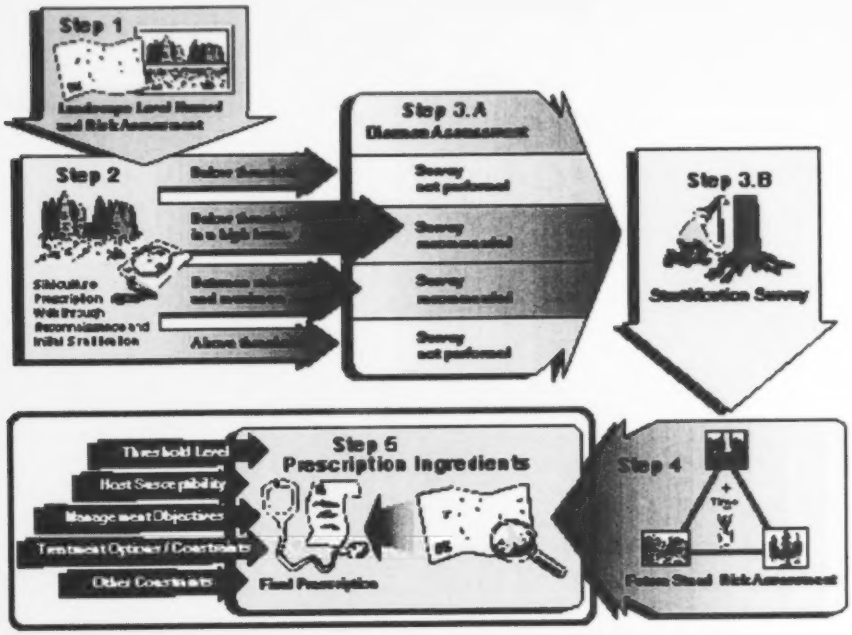
Treatment Options / Constraints
Other Constraints
Final Prescription
Evaluation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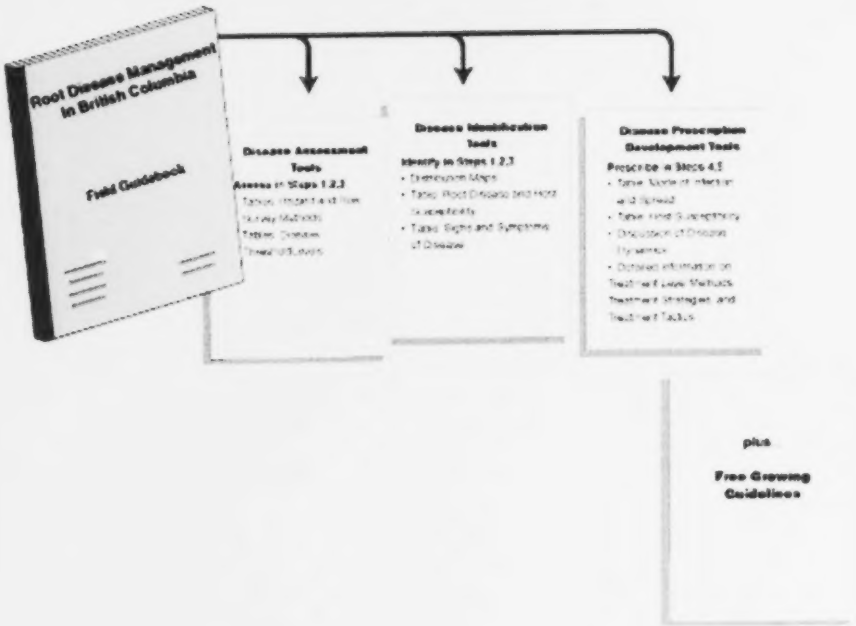
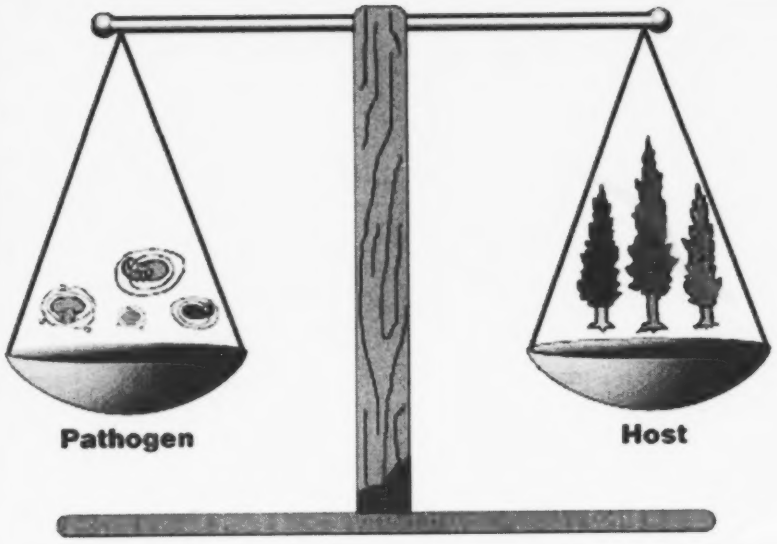
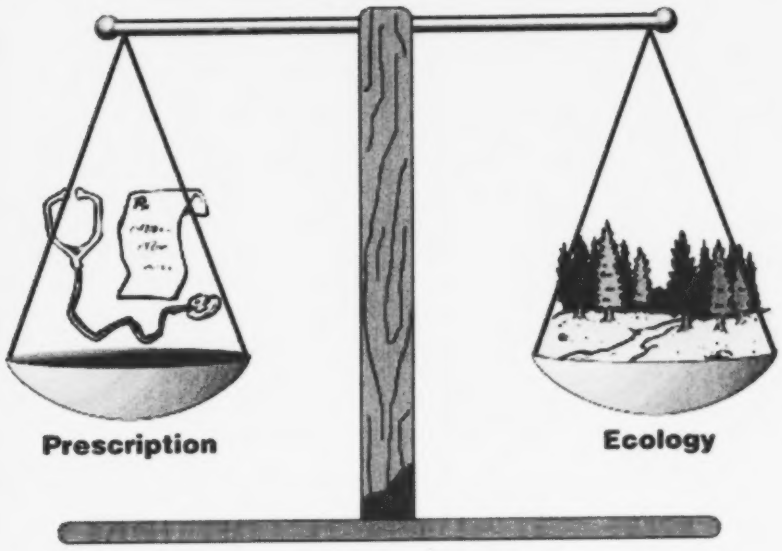
Threshold Level
Final Prescription


Root Disease Management in British Columbia
Field Guidebook
Disease Assessment Tools
Disease Identification Tools
Identify in Steps 1,2,3
Disease Prescription Development Tools
plus
Free Growing Guidelines


Pathogen
Host


Prescription
Ecology

Prince Rupert
Prince George
Williams Lake
Kamloops
Vancouver
Nelson
Victoria
British Columbia
0 100 200 km

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Prince George
Williams Lake
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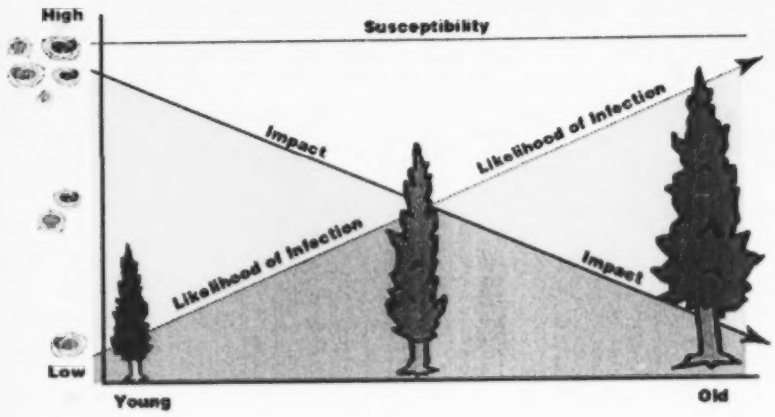
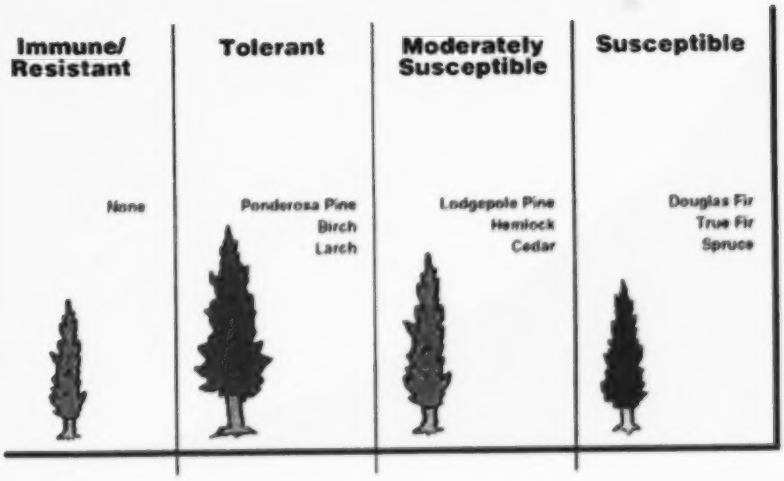
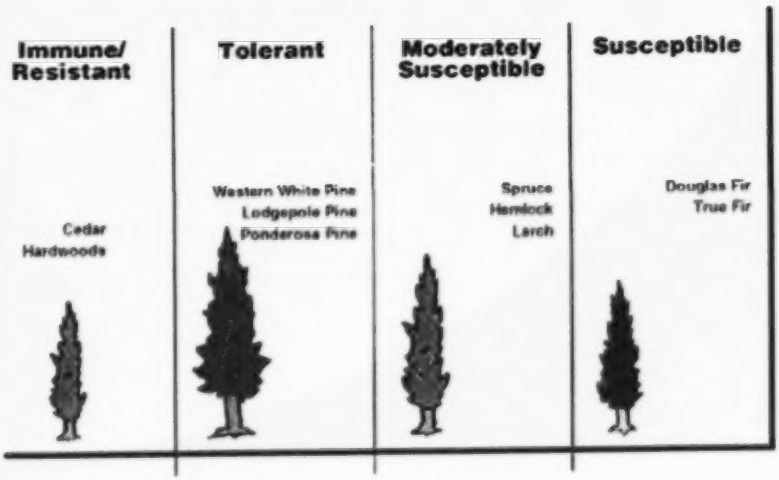
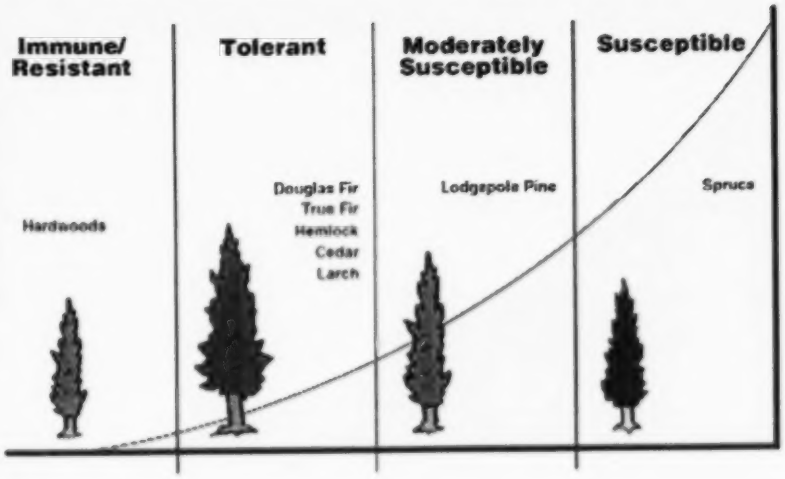
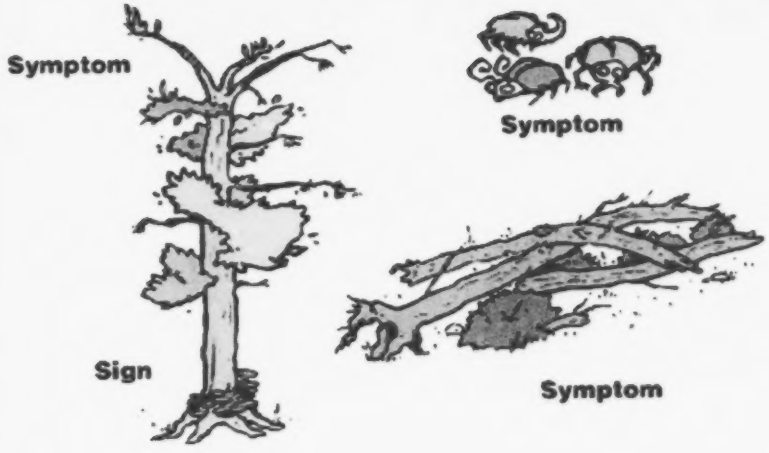
0 100 200 km


High
Susceptibility
Impact
Likelihood of Infection
Likelihood of Infection
Impact
Low
Young
Old


Immune/ Resistant
None
Tolerant
Ponderosa Pine
Birch
Larch
Moderately Susceptible
Lodgepole Pine
Hemlock
Cedar
Susceptible
Douglas Fir
True Fir
Spruce


Immune/ Resistant
Cedar
Hardwoods
Tolerant
Western White Pine
Lodgepole Pine
Ponderosa Pine
Moderately Susceptible
Spruce
Hemlock
Larch
Susceptible
Douglas Fir
True Fir


Immune/
Resistant
Tolerant
Moderately
Susceptible
Susceptible
Hardwoods
Douglas Fir
True Fir
Hemlock
Cedar
Larch
Lodgepole Pine
Spruce


Symptom
Symptom
Sign
Symptom

Laminated Root Rot

- Openings:
  - Distinct, small to large
- Infection centers may be large and fill in with resistant hardwoods
- Species-shift to western red cedar and western hemlock
- Randomly-oriented windthrown stems

Tomentosus Root Rot

- Openings:
  - Small with randomly-oriented windthrown stems
  - Diffuse gaps
  - Mixed conifer with hardwoods and other vegetation
- Species shift to true fir

Armillaria Root Disease

- Openings:
  - Mixed conifer with hardwoods and other vegetation
  - On coast, small clumps of trees in young stands
  - In interior, become larger
- Diffusely spread disease centers

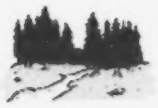
All three diseases

- Poor tree growth and lack of stand vigour
- Insect attack
- Mixture of broadleaved species in conifer stands
- Openings

Laminated Root Rot
- Red foliage stage at death
- Windthrown trees with few or no roots
- Root balls
- Red-brown stained heartwood (disappears 2 to 3 weeks after harvest)

Tomentosus Root Rot
- Red foliage stage at death only if associated with spruce beetle attack
- Windthrown spruce lack fine root mass
- Pink to red-brown stained heartwood

Armillaria Root Disease
- Red foliage stage at death
- Bent top
- Snags and broken stems
- Basal resinosis
- Stringy and yellowish advanced decay with black zone lines



All three diseases
- Chlorotic and thinning foliage (low needle retention)
- Reduced leader growth
- Distress cone crop

Laminated Root Rot

- Cream-coloured mycelia on root surface under dull
- Pinhead-sized pits in wood
- Cinnamon-coloured hair-like hyphae
- Annual rings separate into sheets
- Fruiting bodies (rare) on upturned roots, undersides of decaying logs

Armillaria Root Disease

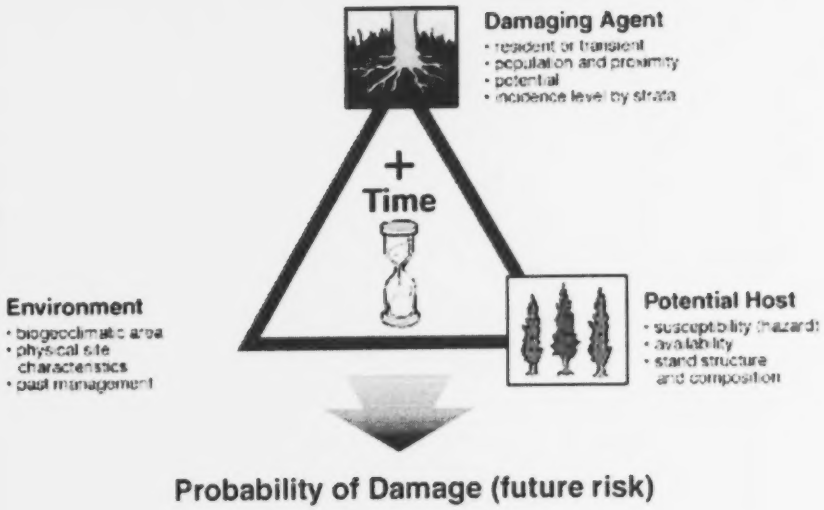
- Mycelia:
  - Cream to white-coloured fan-shaped felts
- On dead trees:
  - Mycelial fan etchings on inner bark, usually associated with resin
- Honey-coloured mushrooms at tree base in fall
- Black shoestring-like rhizomorphs in or around bark of roots (not prolific)

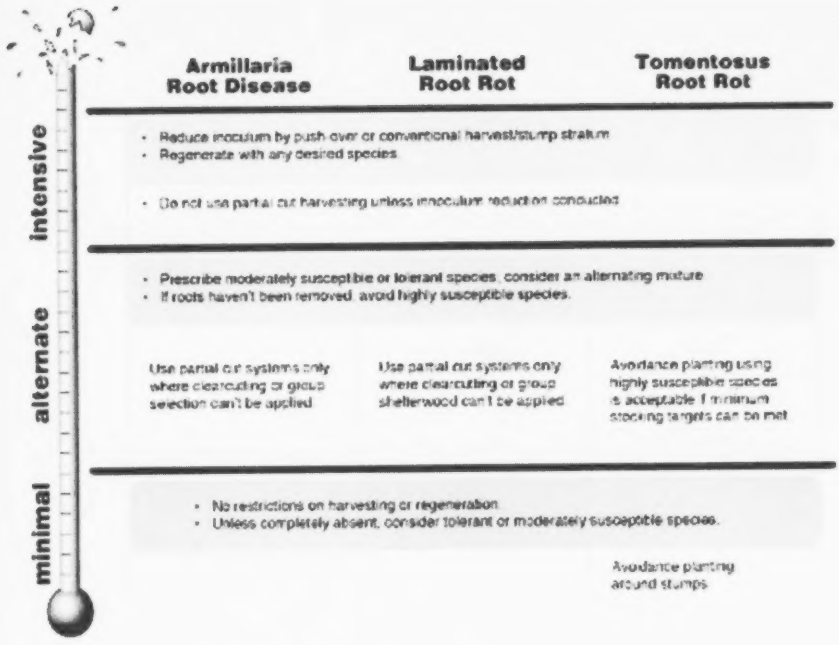
Tomentosus Root Rot

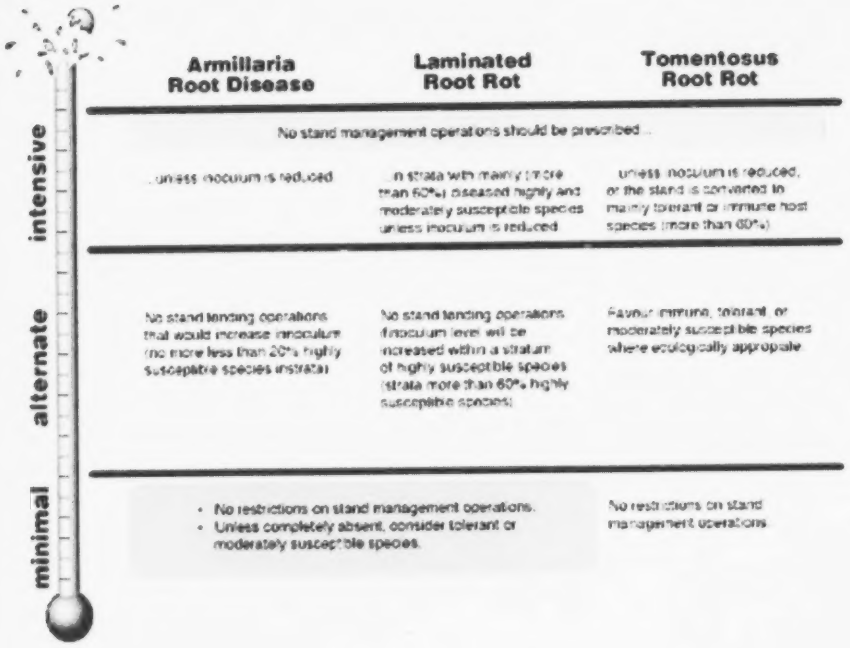
- Canoe-shaped white pitting of heartwood
- Pitting extends to bark with age, follows annual rings
- Honeycomb pattern of decay in execution
- Leathery fan mushroom-like fruiting bodies near decayed roots in fall

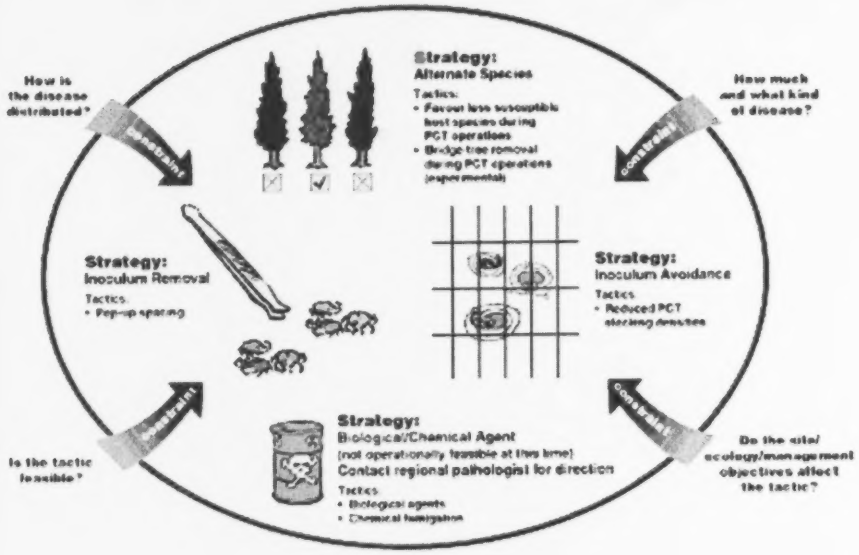
All three diseases

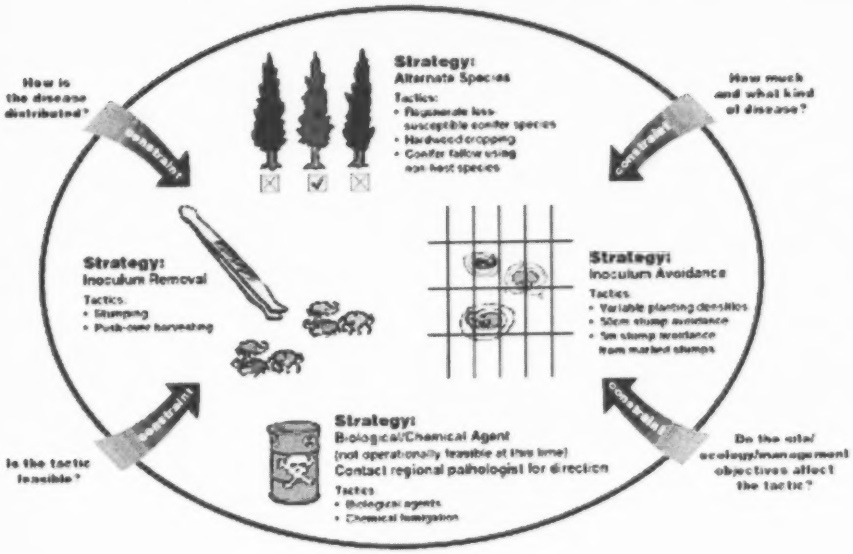
- Fruiting bodies
- Other growths

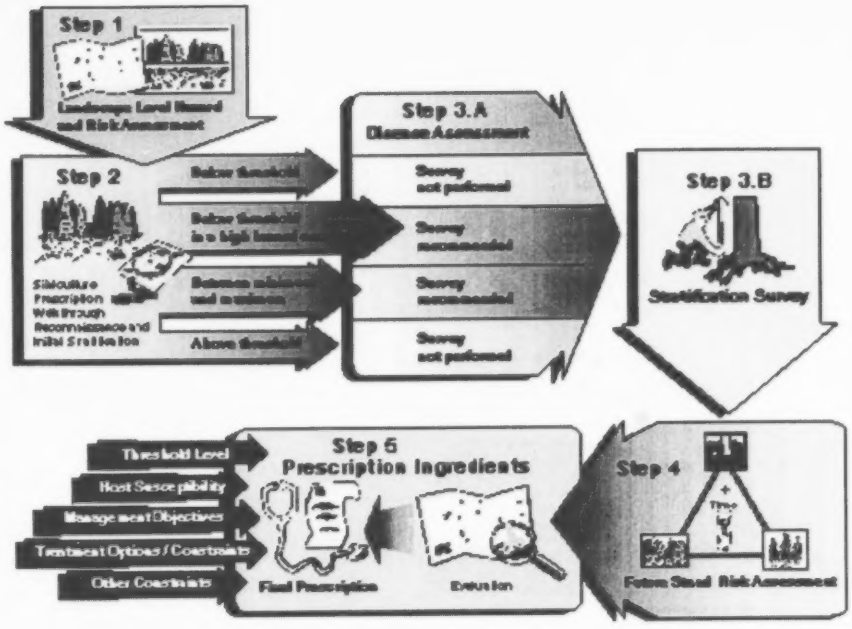

Damaging Agent
• resident or transient
• population and proximity
• potential
• incidence level by strata
+
Time
Environment
• biogeoclimatic area
• physical site characteristics
• past management
Potential Host
• susceptibility (hazard)
• availability
• stand structure and composition
Probability of Damage (future risk)


Armillaria Root Disease
Laminated Root Rot
Tomentosus Root Rot
intensive
alternate
minimal
• Reduce inoculum by push over or conventional harvest/stump stratum
• Regenerate with any desired species
• Do not use partial cut harvesting unless inoculum reduction conducted
• Prescribe moderately susceptible or tolerant species, consider an alternating mixture
• If roots haven't been removed, avoid highly susceptible species.
Use partial cut systems only where clearcutting or group selection can't be applied
Use partial cut systems only where clearcutting or group shelterwood can't be applied
Avoidance planting using highly susceptible species is acceptable if minimum stocking targets can be met
• No restrictions on harvesting or regeneration
• Unless completely absent, consider tolerant or moderately susceptible species.
Avoidance planting around stumps


intensive
alternate
minimal
Armillaria Root Disease
Laminated Root Rot
Tomentosus Root Rot
No stand management operations should be prescribed ...
...unless inoculum is reduced
...n strata with mainly (>60% more than 60%) diseased highly and moderately susceptible species unless inoculum is reduced
...unless inoculum is reduced, or the stand is converted to mainly tolerant or immune host species (more than 60%)
No stand tending operations that would increase inoculum (no more less than 20% highly susceptible species in strata)
No stand tending operations (inoculum level will be increased within a stratum of highly susceptible species (strata more than 60% highly susceptible species)
Favour immune, tolerant, or moderately susceptible species where ecologically appropriate
• No restrictions on stand management operations.
• Unless completely absent, consider tolerant or moderately susceptible species.
No restrictions on stand management operations


How is the disease distributed?
Epidemiology
Strategy:
Alternate Species
Tactics:
• Favour less susceptible host species during PCT operations
• Bridge tree removal during PCT operations (experimental)
How much and what kind of disease?
Consequences
Strategy:
Inoculum Removal
Tactics
• Pop-up spacing
Strategy:
Inoculum Avoidance
Tactics
• Reduced PCT stocking densities
Is the tactic feasible?
Feasibility
Strategy:
Biological/Chemical Agent
(not operationally feasible at this time)
Contact regional pathologist for direction
Tactics
• Biological agents
• Chemical fumigation
Do the site/ ecology/management objectives affect the tactic?
Constraints


How is the disease distributed?
Constraint
Strategy:
Alternate Species
Tactics:
• Regenerate less susceptible conifer species
• Hardwood dropping
• Conifer fallow using non host species
How much and what kind of disease?
Constraint
Strategy:
Inoculum Removal
Tactics:
• Stumping
• Push-over harvesting
Strategy:
Inoculum Avoidance
Tactics:
• Variable planting densities
• 50cm stump avoidance
• 5m stump avoidance from marked stumps
Constraint
Strategy:
Biological/Chemical Agent
(not operationally feasible at this time)
Contact regional pathologist for direction
Tactics:
• Biological agents
• Chemical fumigation
Constraint
Is the tactic feasible?
Do the site/ ecology/management objectives affect the tactic?


Step 1
Step 2
Step 3.A
Step 3.B
Stratification Survey
Step 4
Step 5
Prescription Ingredients
Threshold Level
Host Susceptibility
Management Objectives
Treatment Options / Constraints
Other Constraints
Final Prescription